

**How can differentiated tasks, where
learners self-select the level of difficulty,
affect attitudes towards learning?**

	Target	What I have done in this assignment.
Target 1	I think 1st person would make the essay read more naturally.	I considered this suggestion from ECAD6008 essay. However, because this is written as a professional research study paper it felt more appropriate to use the third person for this assignment.
Target 2	Sustain critical thinking throughout your document	I have tried to maintain this element of my writing throughout

How can differentiated tasks, where learners self-select the level of difficulty, affect attitudes towards learning?

Aim, focus and purpose of the research

The aim of this research was to examine how differentiation strategies can affect attitudes towards learning. During the lessons that were studied, differentiated tasks were created and learners were able to self select the appropriate difficulty level for each task.

This research was carried out in Year 7 mixed ability science classes at school X. Both classes involved in this research contained a wide range of abilities including more able and talented (MAT) learners and learners with additional learning needs (ALN). This kind of academic diversity has become more commonplace (McCoy and Ketterlin-Geller, 2004) and strategies are required to ensure all learners are able to make progress. A one size fits all approach to teaching in these classes poses a risk of leaving some learners unable to understand the basic requirements of the work and unable to make progress; and others not receiving adequate challenge in relation to their ability (Forsten, Grant, and Hollas, 2002).

The primary aim of this research was focussed on differentiation as a strategy to improve learning. However, during the research itself an additional area of interest (lesson pace) appeared which is also briefly discussed in this paper.

Research Context

This research was conducted entirely at a large secondary school located in a city in South Wales. This is a mixed gender English medium school that provides key stage 3, 4 and 5 education with an age range of 11-19 years. The pupil population in the school is approximately 1700, including around 350 in the sixth form.

According to mylocalschool.gov.wales (2020), in 2018, 6.5 % of pupils in the school were eligible for free school meal, which is well below the national average for Wales of 16.6 %.

In the most recent Estyn Report (Estyn, 2018) the school was judged to be Excellent in all five inspection areas. The school is also in the GREEN support category and is a pioneer school, working with Welsh Government, and other schools, to develop the new curriculum in Wales.

For the purposes of this assignment, the placement school will be referred to as school X in accordance with good practice guidance for the completion of educational research (BERA,

2018). Both researchers were PGCE student teachers at school X during the period of research.

Literature Review - Differentiation

In mixed ability classes with a wide range of ability, differentiation can play a key role in helping every student experience the satisfaction associated with completing work that has challenged them (Stronge, 2004). In addition, tackling differences between learners can increase motivation and commitment to learning (Tomlinson, 2016). In order to maximise learners progress, teachers should attempt to set work that is not too difficult and not too easy. Known as the zone of proximal development, originally proposed by Vygotsky, this is the level of difficulty that can deliver the greatest improvement (Nordlof, 2014; Svinicki, 2015). Clearly, it would not be possible to teach using a single instructional method, setting one task for an entire mixed ability class and expect all learners to be working in the zone of proximal development (Fisher and Rose, 2001). Therefore, differentiation offers an opportunity to bring more learners into this optimal zone for progress.

In order to deliver effective differentiated lessons teachers must meet two requirements which are: (a) excellent knowledge of each learners strengths and needs and (b) sufficient knowledge of the subject that is being taught (Valiandes, 2015). Differentiation requires teachers to understand the “unique biography” of every learner to allow teaching and learning to take place at different levels across the classroom (Koutselini, 2006). This maximises the opportunity for growth for every learner in a class and can play a role in delivering social justice and equity in the classroom (McLoughlin and Talbot, 1993). Implementing differentiation in teaching can also result in learning becoming a more collaborative process, with responsibility for progress shared between teacher and learner (Tomlinson, 2004).

Studies have shown positive outcomes related to the use of differentiation in teaching. Simpkins, Mastropieri and Scruggs (2009) completed a study where the context of the research study closely aligned with the context associated with the research described in this paper. They found that test scores in mixed ability middle school science classes improved in classes who received differentiated instruction. In addition, learners and teachers found the process of differentiation interesting and enjoyable.

Johnsen (2003) worked with student teachers to encourage greater use of differentiation in lessons. This study showed that learners were more engaged in lessons where differentiation strategies were implemented. In addition, the student teachers also found their teaching more rewarding. Johnsen describes how learners with additional learning needs continued to

receive individual support during the study. This could indicate that differentiation alone cannot tackle the academic diversity seen in some classes. Kim (2005) found that learners in mixed ability classrooms who received differentiated lessons achieved higher academic grades and also an increase in motivation to learn. Chamberlain and Powers (2010) showed that differentiated lessons in undergraduate university maths classes resulted in greater improvement compared to classes where differentiation was not used. McAdamis (2001) found that implementation of differentiation resulted in significant improvement in lower ability learners performance. This study also discussed the challenges associated with rolling out a differentiation model into schools with significant resistance reported from experienced teachers. Whilst teacher resistance to implementing differentiation has been reported in a number of other studies (e.g. Corley, 2005; McAdamis, 2001), Johnsen (2003) found that those teachers who had embraced differentiation as a regular part of their practice reported improved perceptions of their own teaching effectiveness and greater job satisfaction.

Whilst there are now numerous studies that demonstrate some improvements in learner performance associated with implementing differentiation strategies, the majority of these studies are limited to small sample sizes and often focus only on particular groups of learners within a class. This lack of large scale meta-analyses of the impact of differentiation; alongside reports from teaching professionals that differentiation is time consuming and difficult to implement (Corley, 2005; McAdamis, 2001); means that there remains a need for further research into this field in order to quantify the benefits of differentiation as a strategy to enhance teaching and learning.

Differentiation by task, where different tasks are given to different learners risks creating resentment between learners who are set different tasks within the same class (Wellington, 2000). When setting differentiated tasks, learners can receive the task of suitable difficulty directly from the teacher, or alternatively all task options can be offered to learners who then have the option to select the task which they feel suits their ability best (Piggot, 2002). This approach of allowing learners to select the task that they feel is appropriate for them might occasionally lead to learners selecting tasks that are too easy or too challenging for them, but if the approach is regularly used then learners should be able to accurately self select the right level of challenge (Sumner, 2012).

The review of literature regarding differentiation described above led the research team for this study to investigate the question of “how can differentiated tasks, where learners self-select the level of difficulty, affect attitudes towards learning?”

Lesson Study Design

The methodology used in this research was lesson study which is a form of action research that enables teachers to refine teaching approaches through repeated lesson observation and reflection. Lesson study research methodology was pioneered in the UK by Dudley (2015). It requires groups of teachers to collaborate in the planning, teaching and observing of lessons in order to identify ways of improving teaching and learning.

During a lesson study cycle a group of teachers (in this case a pair) complete the following steps. Information specific to this research are shown in blue:

1. Identify a focus for pupil learning. [Achieving good attitude to learning.](#)
2. Jointly identify a teaching technique to develop. [Differentiation by task.](#)
3. Identify three "case pupils" who will be observed during research lessons.
4. Jointly plan a research lesson.
5. Teach and observe the lesson focussing on the case pupils learning and progress.
6. Interview the case pupils to understand their perception of the lesson.
7. Hold a post research lesson discussion to analyse how effective the teaching was and how well the case pupils progressed.
8. Repeat points 4-7 with a different class ([both lessons were Year 7 science classes](#)).
9. Formally share the outcomes with other teachers in order to help colleagues benefit from the research completed.

The three focus pupils in the two lessons completed for this lesson study were selected to try and assess how the differentiated tasks were perceived by pupils with different ability levels. Therefore, for each lesson one lower ability, one mid-range ability and one higher ability pupil were selected as the focus pupils.

During the research lessons, one of the researchers taught the lesson whilst the other acted as a non-participant observer. The non-participant approach to observation should limit any change in behaviour of participants. The focus pupils were aware that they would be observed and interviewed by both researchers after the lesson and the author recognises that this could have resulted in participants behaving differently. This effect is known as the Hawthorne effect (Payne & Payne, 2004).

The lesson observation attempted to assess attitude to learning of the participants using a number of quantitative and qualitative methods. This included keeping track of the focus pupils engagement in the lesson by logging when they volunteered to answer questions and recording how quickly focus pupils started on tasks when work was set. The observing

researcher also attempted to assign each focus pupil with a Leuven Involvement scale score (Laevers, 2005) to attempt to assess the learners attitude towards learning. In addition, free text notes were taken regarding the behaviour of the focus pupils during the lesson. Whilst collecting quantitative data may be preferable in terms of completion of data analysis, educational research rarely allows purely quantitative data to be used. In addition, the collection of qualitative information adds a richness to the data collected that can sometimes explain some the reasons for the behaviours witnessed during a lesson. Copies of the completed lesson observations can be found in the appendices.

Following the research lesson, and group interview with the focus pupils, the researchers completed detailed reflection activity. A proforma was developed combining the ideas of the Gibbs reflective cycle (1988) and Brookfield's lenses (2017). The Gibbs reflective cycle covers six stages of reflection as follows:

1. Description of the experience
2. Feelings about the experience
3. Evaluation of the experience (good points and bad points)
4. Analysis of the situation
5. Conclusion about what was learned
6. Action Plan detailing what would be done differently next time.

The Brookfield lenses examine a situation from a number of viewpoints (self, peer, learner and literature). The nature of this research, where two student teachers were teaching and observing lessons and where learners are being interviewed following the lesson, fits in well with the Brookfield lenses model and by combining this approach with the Gibbs reflective cycle it was possible to review the feelings of the teacher, peer and learner in relation to the research lessons.

Wherever possible, differences between the two lessons being studied were minimised. Both lessons were completed on the same topic, with the same lesson plan being used by both teachers (with some refinements for research lesson 2). Both lessons were received by mixed ability Year 7 science classes and efforts were made to select similar ability levels for the focus pupils across both lessons. However, it should be recognised that there remain some limitations to this research when attempting to make conclusions about what was witnessed in the lessons. No two classes are ever identical in their make up, and the lesson study design, where a different teacher teaches each lesson, also results in potential differences in learner experience and engagement which could be unrelated to the area being studied.

Ethical Considerations

As described above, three focus pupils in each lesson were observed and subsequently interviewed immediately after the lesson. The focus pupils were aware before the research lesson that they were to be observed and interviewed and consent from parents and assent from learners was obtained prior to the research commencing. Participants were regularly reminded that they were able to withdraw from the research at any point. In this research no focus pupils chose to withdraw.

Interviews were carried out with focus pupils in a group interview. At the start of the interview participants were reminded of their right to withdraw and were also advised that they did not have to answer any questions that they did not wish to. Interviews were recorded using a digital voice recorder. Immediately after the interviews, the recordings were transposed into digital text format and the audio recordings were permanently deleted.

All electronic information for this research has been stored on a Microsoft OneDrive folder that can be accessed only by the two researchers.

No participant names have been included within the final research documentation. Any documentation that included the participants' names that was used during the research has had the name and any other identifiable features permanently redacted from electronic images.

Paper notes taken during the completion of the research were kept in a locked drawer at school X and were subsequently destroyed (shredded) when the information had been converted into electronic format.

All actions and decisions made in regard to confidentiality and anonymity were completed in line with the Bera Ethical Guidelines for Educational Research (2018).

Lesson study – description of the research lesson

The lesson being taught in both research lessons focussed on graphing skills, with weather forecast rainfall and temperature information being captured and plotted. Producing and interpreting graphs is a key scientific skill that learners need to master during key stage 3 and 4. In both the chemistry and physics WJEC GCSE (higher) papers, graph skills have been tested in every past paper for the last five years and the marks available for producing a graph correctly are often worth a whole grade boundary in terms of raw marks (WJEC, 2020).

Another reason that the researchers selected graphing skills as the focus for the lesson was because it provides multiple opportunities to employ differentiation through additional

scaffolding being provided for lower difficulty tasks. For example, graph axes were pre-drawn onto printed graph paper for the easier tasks whereas on the most difficult worksheet a sheet of plain graph paper was provided. During the planning of the research lessons the researchers discussed how best to label the tasks with different difficulty levels. The researchers wanted to avoid labelling the tasks simply as “easy, medium and hard” as this could pose a risk that some learners could feel some resentment to peers or embarrassment about selecting a task perceived as too easy. Following some discussion the researchers decided to define the tasks as mild (easy); medium (medium); and hot (hard).

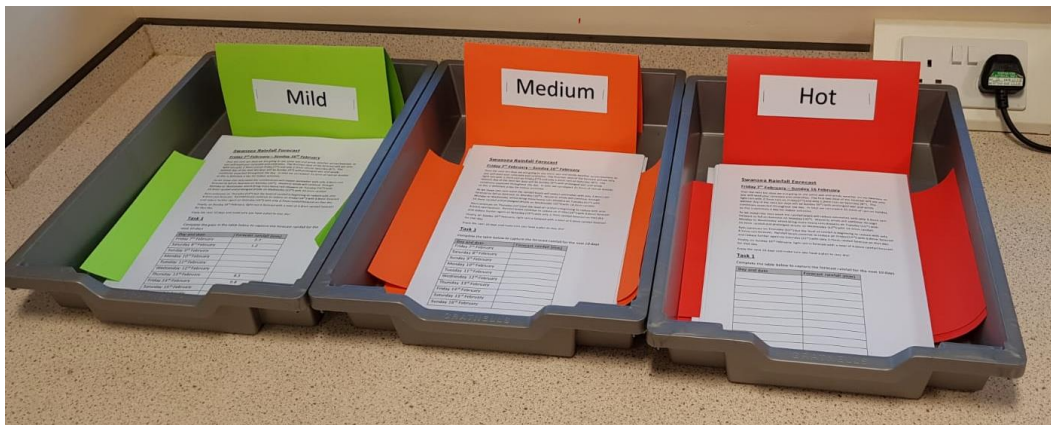


Figure 1. *Presentation of the differentiated task worksheets*

The lesson was split up into four key tasks as follows:

- Task 1 capturing numerical information from a text and entering it into a table;
- Task 2 using the data captured in the table to draw a bar chart;
- Task 3 capturing numerical maximum and minimum temperature information from weather forecast maps and entering it into a table;
- Task 4 using the information captured in the table to draw a line graph showing the forecast maximum and minimum temperature.

On the worksheets for task 2 and task 4 differentiated questions were also included to be completed after drawing the graphs.

Each of the four tasks were differentiated into mild, medium and hot worksheets and learners were able to select a different level of difficulty for each of the four tasks, allowing them to “mix and match” the difficulty level as they progressed through the tasks. The researchers chose to use this approach because it allowed learners who may not have selected the correct level of challenge for the initial task to change later on.

The plenary at the end of the lesson was a peer assessment task where learners reviewed their neighbours line graph and provided positive feedback and constructive criticism.

Lesson study 1 – results and analysis

The first lesson was taught by researcher A and observed by researcher B. A summary of the lesson and key learning points is provided below.

The student teacher spent approximately 10 minutes explaining the first task to the class before instructing the learners to select what they deemed to be the appropriate worksheet for the first task. In the planning of the first lesson the researchers had agreed to try to keep all learners working on the same task at the same time. This resulted in some learners quickly completing the first task and having to wait for the remainder of the class to catch up before they could move on to the second task. The student teacher then proceeded to explain task 2 to the class and again learners came and selected the appropriate worksheet for drawing the bar chart. As with the first task, the progress made by the class rapidly stratified with some of the more able learners quickly completing the bar chart and the differentiated questions while other learners were making slower progress. The student teacher decided to allow the more able learners to proceed to task 3 and 4 which resulted in the lesson becoming slightly disjointed with the student teacher having to spend a considerable amount of time with the more able learners explaining the next task whilst also trying to help the rest of the class make progress.

Toward the end of the lesson the more able learners found that the final differentiated question on task 4 was problematic because it asked learners to compare rainfall and temperature data in different geographic location and attempt to identify a correlation. The learners struggled to attempt the question as they viewed it as impossible. This took up some time for the student teacher which could have been better spent supporting the rest of the class complete the bar chart.

At the end of the lesson the majority of the class had completed their rainfall data table and bar chart (tasks 1 and 2) but only three learners had completed the line chart. This meant that the plenary had to be modified to focus on self-assessment of the bar chart.

Following the lesson, the focus pupils were interviewed and the key themes coming from this interview are shown below:

- the learners liked that they could change between mild, medium and hot tasks as they progressed through the work;

- the learners struggled with plotting the rainfall data which was provided to one decimal place on the scale on the chart;
- the lower ability learners said that they found extracting data from the text difficult and suggested making this easier on the mild worksheet;
- the high ability learner said that they were bored in the lesson because the tasks were too easy.

Following the lesson and group interviews, the researchers reviewed the completed observation template and worked together to complete the combined Gibbs and Brookfield reflection template. The observation template showed an average Leuven scale score for the three focus pupils across the different tasks of 3.9. The subsequent reflections resulted in the following action plan points for consideration for research lesson 2:

- increase pace of explanation of initial task to get learners onto the worksheets as quickly as possible;
- explain task 1 and 2 at the start of the lesson and allow learners to progress through to task 2 as soon as they finish task 1;
- have an additional stretch and challenge task planned that can be put up onto the board if required for any learners who competes tasks 1-4;
- amend graph paper provided to make the scale for the graph easier to work with when dealing with figures to one decimal place;
- provide additional scaffolding on the mild worksheet for task 1 making it easier for learners to find the data that needs to be entered into the table;
- during the lesson, the student teacher should provide some general information to learners about the tasks that will be coming up next and provide time limits for the current task to be completed. This should provide the learners with a greater incentive to complete the task they are working on.

These points were incorporated into the lesson plan for lesson study 2.

Lesson study 2 – results and analysis

The second lesson was completed with the teacher and observing roles reversed. The plan for the lesson and lesson resources had been amended in line with the action plan points detailed for lesson study 1. A brief overview of the lesson is provided below.

The student teacher spent only 3-4 minutes explaining the task for task 1 and 2. Whilst the explanation was much quicker than in lesson study 1, it covered all the key points required and ensured that the learners got on with the first tasks as quickly as possible. The student

teacher provided regular information to the class about the time remaining on each task and also provided general information about what was coming next so that learners were aware that further tasks were to be completed during the lesson.

The amendments to the differentiated worksheets resulted in the less able learners in the class making more progress on each task which resulted in almost everyone in the class completing the bar chart before anyone had completed all the supplementary questions related to the chart.

The teacher then explained tasks 3 and 4 to the class and set a clear timescale for completion which was reiterated to the class regularly. This again resulted in almost all learners in the class being able to complete the graph and there was also time at the end of the lesson for the learners to complete the peer assessment task.

Following the lesson, the three focus pupils were interviewed and the key themes coming from this interview are shown below:

- all the learners reported that they found the lesson quite easy;
- the medium and high ability learners, who both completed the hot worksheet for the line graph, found the final question on this sheet challenging;
- all learners enjoyed drawing and shading their graphs;
- all learners said that they liked having the option to select the mild, medium or hot worksheets;
- the medium and high ability learners said that they would have liked some additional questions on the final worksheet because they had finished everything with a couple of minutes before the plenary.

Following the lesson and group interviews, the researchers reviewed the completed observation template and worked together to complete the combined Gibbs and Brookfield reflection template. The observation template showed an average Leuven scale score for the three learners across the different tasks of 4.1. The subsequent reflections resulted in the following action plan points for consideration for future practice:

- consider providing additional scaffolding for mild tasks to help learners progress at the same speed as their peers;
- have additional extension tasks ready which are suitable for learners to spend a short time on. The prepared extension task for this lesson was too large to give to learners only a couple of minutes before the plenary;

- spend a little more time explaining the differences between the mild, medium and hot tasks. In the second lesson study very few learners selected the mild worksheet with the majority selecting hot worksheets.

At this point the lesson study research came to an end. However, these points can be considered as general points for consideration for the researchers' future teaching practice.

Discussion of research findings

This research has shown that learners appear to enjoy lessons where they have access to differentiated tasks. In addition, learners stated that they liked the freedom to select the level of difficulty and also valued the option to change level between each task. This view was voiced by all six focus pupils interviewed after the research lesson but was perhaps best explained by the mid-range ability pupil from lesson study 1 as shown below:

"I solidly agree with [pupil 3], like if it's just one worksheet everyone is going to have that sheet and some people may not find that sheet for them. Like but with the new mild and medium and hot, that actually sets the right thing for you. And you can decide whether it's good for you. And the best part is you can change in-between. Like with the one sheet it's just one sheet you have to do it, however with the hot medium mild if I started at hot, I was like mmm nah this isn't for me. I can go back to medium and then if medium wasn't the right one for me then I could go to mild. Then mild, well hopefully its right one for me."

This preference for having a choice of differentiated tasks has been reported previously (Arzhanik et al, 2015) where the benefits reported included increased motivation for learning whilst also providing learners with an opportunity to self assess areas of strength and challenge.

During the research and group interviews it became clear that learners may not have fully understood the differences between the mild, medium and hot tasks. In the two classes there were different proportions of learners who selected tasks of different difficulties. This was possibly due to the different researchers teaching the two lessons and explaining the difficulty level differently. It may also reflect the overall ability levels across the two classes or, more specifically, the confidence that each class had in their graphing skills. The breakdown of each class's selection of differentiated tasks are shown below.

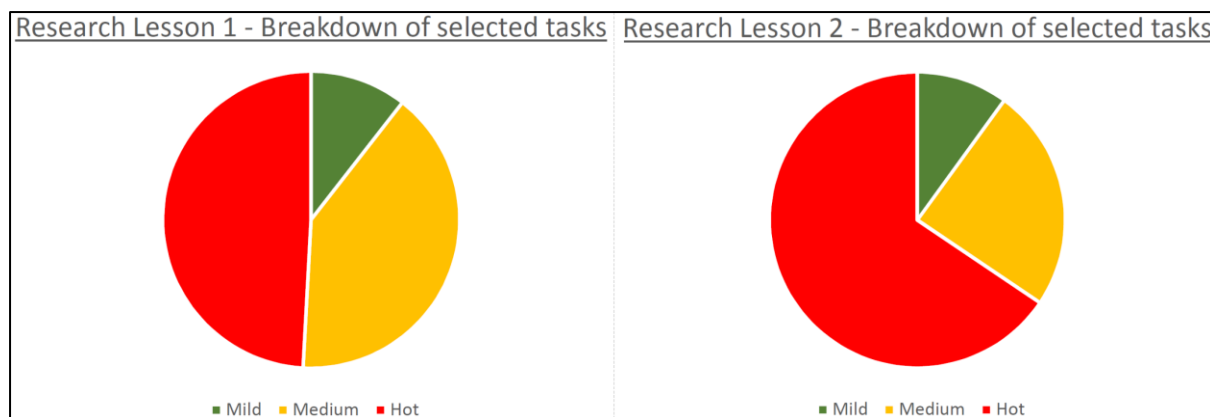


Chart 1 - chart showing differences in worksheet selection in the two research lessons.

The lesson study approach used for this research was well suited to the researchers' current experience in teaching and educational research. By working as a team, the researchers were able to collaborate in researching, planning and delivering the lessons. This provided both researchers with insight into the others approach to various elements of lesson planning and teaching and both researchers have since commented on how this experience has identified areas for improvement in their practice. For example, progress of most learners in lesson study 1 was delayed, in part, due to the student teachers slower instruction and desire to hold back information about upcoming tasks. In future I will try and incorporate the technique used by researcher 2 in research lesson 2 where tasks were explained quickly, and upcoming tasks are signposted whilst learners are working on the current task. This approach allows learners more time to complete the task and also creates an incentive for learners to maintain pace of work.

Conclusion

This research attempted to test how differentiated tasks can improve learners attitude to learning. The lesson study approach does not allow for the provision of a control class to compare classes where differentiation is incorporated with classes where it is not, However, the study did demonstrate that learners enjoyed and appreciated the opportunity to select tasks of different difficulty, and it is suggested that this appreciation could result in increased motivation and longer term performance improvements if differentiation were used regularly in future. In addition, the differentiation within the tasks somewhat countered the natural tendency of the more able learners to finish their work much sooner than others in the class.

Limitations of this differentiation approach are that the provision of multiple differentiated worksheets can create additional workload in planning lessons and also it is inevitable that some worksheets will be left at the end of the lesson unused. If this approach were to be used

within a school these limitations could be mitigated by sharing the workload of creating differentiated tasks amongst the teachers in the department and by holding a “stock” of worksheets allowing unused worksheets to be returned for use in future lessons.

The observation templates developed for this research were effective in capturing information on the focus pupils’ engagement in the lesson. By capturing quantitative and qualitative data on the focus pupils during the lesson it was possible to compare different learners and different lessons. The difference in Leuven involvement scale and general engagement metrics across the learners and classes was found to be quite small. This may have been because the focus pupils were made aware before the lesson that they were going to be observed and interviewed so their behaviour may have altered. To observe the focus pupils without telling them beforehand would have posed significant ethical concerns so this appears to be an inevitable limitation with the research method selected.

The combined Gibbs reflective cycle and Brookfield lenses reflection template that was developed for this research was a very useful tool in identifying what happened; why it happened; and the conclusions that could be drawn from each incident. By examining the lesson from the teacher, observer and learners’ perspective the researchers were able to identify clear conclusions and action points following both research lessons.

In summary, this research study has provided additional evidence of the educational benefits of using differentiation strategies in mixed ability classes. In particular, the use of pupil managed differentiated tasks (Piggot, 2002) where learners can select the appropriate level of difficulty themselves appears to have been popular with learners and generated additional motivation to succeed in lessons. In future, the author plans to increase the use this approach in the next professional teaching experience placement in order to help all learners to make good progress irrespective of their ability level.

Planning, teaching and observing a lesson as a pair of researchers has also allowed other areas of practice to be examined, and in future the author will aim to be more concise when explaining a task to a class and will clearly signpost additional tasks that will be covered to ensure all learners have an incentive to work efficiently through the work in front of them.

Recommendations

In light of the research described in this paper it is suggested that differentiation by task is an effective method of achieving good progress across a mixed ability class. The author plans to use this approach and test it further on the second professional teaching experience placement starting in March 2020.

In order to provide more robust evidence for the benefits of this approach to differentiation, it may be beneficial to complete further research where different pedagogical approaches are implemented in different classes. This could allow comparisons to be made between classes where a differentiation by task is adopted with other classes where the approach is not used.

In addition, whilst not a focus of this research, the author has identified that increasing lesson pace, and reducing the amount of time explaining tasks, is be an area where a change of personal approach may deliver improved results for learners. This will be taken forward into the next professional teaching experience placement.

In school, learners are not generally interviewed after lessons. This research shows that learners can provide excellent feedback to teachers that can, in turn, improve the effectiveness of the teacher. The author plans to use learner feedback more in future in order to further improve practice.

Finally, planning and teaching lessons is usually a solitary activity completed by single teachers. This work has also demonstrated the benefits of collaborating with other (student) teachers to identify opportunities to improve. This collaborative approach will be taken forward by the author into the next professional teaching practice placement.

The learning from this research was shared informally with all PGCE students completing their placements at school X and also with a number of teachers at school X.

References

Arzhanik M.B., Chernikova E.V. , Karas S.I., and Lemeshko E. (2015) 'Differentiated approach to learning in higher education' *Procedia - Social and Behavioral Sciences* Vol 166 pp. 287 – 291

British Educational Research Association (BERA) (2018) *Ethical guidelines for educational research*. 4th edn. Available at: <https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018> (Accessed: 08 January 2020).

Brookfield, S (2017) *Becoming a Critically Reflective Teacher* 2nd Ed. San Francisco: John Wiley and Sons Inc.

Corley, M. (2005). 'Differentiated instruction: Adjusting to the needs of all learners.' *Focus on the Basics*, Vol 7C.

Dudley, P. (2015) *Lesson Study: professional learning for our time*, London, Routledge

Estyn (2018) *A Report on [REDACTED]*. Date of Inspection: February 2018 Available at [https://www.estyn.gov.wales/sites/www.estyn.gov.wales/files/documents/\[REDACTED\]](https://www.estyn.gov.wales/sites/www.estyn.gov.wales/files/documents/[REDACTED]) (Accessed 12 January 2020)

Fischer, K. W., and Rose, L. T. (2001). 'Webs of skill: How students learn.' *Educational Leadership*, Vol 59(3), pp. 6-123.

Forsten, C., Grant, J., and Hollas, B. (2002). *Differentiated Instruction. Different Strategies for Different Learners*. Peterborough: Crystal Springs Books.

Gibbs, G. (1988). *Learning by doing: A guide to teaching and learning methods*. London: Further Education Unit.

Johnsen, S. (2003). 'Adapting instruction with heterogenous groups.' *Gifted Child Today*, Vol 26(3), pp. 5- 6.

Kim, J. S. (2005). 'The effects of a constructivist teaching approach on student academic achievement, self-concept, and learning strategies.' *Asia Pacific Education Review*, Vol 6(1), pp. 7–19

Koutselini, M. (2006). *Differentiation of teaching and learning in mixed ability classrooms*, Nicosia

Laevers, F. (2005). *Well-being and Involvement in care settings. A process-oriented Selfevaluation Instrument (SIC's)*. Leuven: Kind en gezin; Research Centre for Experimental Education

McAdamis, S. (2001). 'Teachers tailor their instruction to meet a variety of student needs.' *Journal of Staff Development*, Vol 22(2), pp. 1-5.

McCoy, J. D., and Ketterlin-Geller, L. R. (2004). 'Rethinking instructional delivery for diverse student populations.' *Intervention in School and Clinic*, Vol 40(2), pp. 88-95.

McLaughlin, M., & Talbert, J. (1993). *Contexts that matter for teaching and learning: Strategic opportunities for meeting the nation's educational goals. Center for Research on the Context of Secondary School Teaching*. Stanford, California. CRC

mylocalschool.gov.wales (2019) *Sharing Information about Local Schools* Available at <http://mylocalschool.gov.wales/School/██████████lang=en> (Accessed: 12 January 2020)

Nordlof, J. (2014) 'Vygotsky, Scaffolding, and the Role of Theory in Writing Center Work', *Writing Center Journal*, Vol 34(1), pp. 45–64

Payne, G & Payne, J (2004) *Key Concepts in Social Research* London: Sage Publications

Piggot A. (2002), 'Putting differentiation into practice in secondary science lessons,' *School Sci. Rev.*, Vol 305, pp. 65–73

Simpkins, P., Mastropieri, A., & Scruggs, T. (2009). 'Differentiated curriculum enhancements in inclusive fifth-grade science classes.' *Remedial and Special Education*, Vol 30, pp. 300–308.

Stronge, J. (2004). 'Teacher effectiveness and student achievement: What do good teachers do?' Paper presented at the American Association of School Administrators Annual Conference and Exposition, San Francisco, California.

Sumner, C. (2012). 'Differentiation by Task'. *Teaching Business & Economics*, Vol.16 (3), pp.5-7

Svinicki, M. (2015). 'The Goldilocks Principle'. *The National Teaching and Learning Forum* Vol 24:4, pp. 11-12

Tomlinson, C. A. (2004). 'Sharing responsibility for differentiating instruction.' *Roeper Review*, Vol 26(4), pp. 188-200.

Tomlinson, C. A. (2016) 'Why Differentiation Is Difficult: Reflections from Years in the Trenches.' *Australian Educational Leader* Vol 38.3: pp. 6-9.

Valiandes, S. 2015, 'Evaluating the impact of differentiated instruction on literacy and reading in mixed ability classrooms: Quality and equity dimensions of education effectiveness', *Studies in Educational Evaluation*, Vol. 45, pp. 17-26.

Welsh Joint Education Committee (2020). Past Paper for physics, chemistry and biology GCSE Higher tier. Available at: <https://www.wjec.co.uk/students/past-papers/> (Accessed 16 February 2020)

Wellington, J. (2000) *Teaching and learning in secondary science; contemporary issues and practical approaches*. London: Routledge.