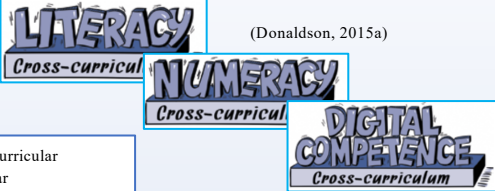


Reference list
Barnes, J. (2015a) *Cross-curricular learning 3-14*. 3rd ed. London: SAGE Publications Ltd.
Donaldson, G. (2015b) *Successful Futures*. Crown copyright.
Estyn. (2018) *The Annual Report of Her Majesty's Chief Inspector of Education and Training in Wales 2016-2017*. Cardiff: Crown.

Entrepreneurs

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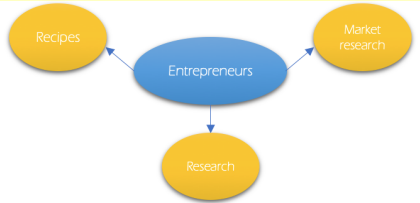


(Donaldson, 2015a)

Barnes (2015a) and Savage (2011) state effective cross-curricular teaching and learning allows learners to apply and develop a range of skills, knowledge, and attitudes within a learning experience. Donaldson (2015b) recommends the implementation of literacy, numeracy, and digital competence as cross-curricular responsibilities within Wales' new curriculum, whereby said skills are applied and developed in a range of contexts across the curriculum. Therefore, the aim of this body of work is to exemplify the implementation of two cross-curricular models, theme-based and opportunistic, to develop the cross-curricular responsibilities within design and technology and history. The following activities are underpinned by the recommendations and four purposes of Wales' new curriculum and develop aspects of the science and technology and humanities Areas of Learning and Experience (Donaldson, 2015b). The overarching theme, 'Entrepreneurs', develops the core purpose of education that supports learners becoming '*enterprising, creative contributors*' that make connections between different areas of their knowledge and apply their skills to the creation a product (Donaldson, 2015b). The following activities are intended for year four learners.

Theme-based cross-curricular approach

Barnes (2015a, p.69) describes theme-based cross-curricular approaches as the utilisation of a theme to '*generate exploration*' through the '*eyes*' of a number of subjects. Similarly, Lawrence (2015) identifies theme-based teaching as the integration of curriculum areas which are underpinned by a common theme. This implies this approach allows the application and development of learners' cross-curricular responsibilities in the contexts of another subject. Estyn (2018, 2015b) highlight the need for theme-based cross-curricular approaches as a number of schools do not implement the cross-curricular responsibilities effectively and suggests this approach is an effective and successful model. Additionally, Donaldson (2015b, p.29) exemplifies this approach will support learners developing as '*ambitious, capable learners*' who '*connect and apply*' their knowledge in different contexts as, stated by Barnes (2015a) and Lawrence (2015), learners will apply the cross-curricular responsibilities to the development of another subject.



Benefits and limitations

Johannessen (2000) highlights theme-based teaching integrates subjects rather than separate them into units of work, to which Cameron (2001) and Min (2012) suggests creates a meaningful learning context. Research suggests that integrating subjects supports the development of connections between brain cells which supports long-term memory of said subjects and skills (Ebbinghaus, 1885; and DCELLS, 2008a). This implies that conducting theme-based teaching will support learners' progression of the cross-curricular responsibilities as they will be applied to a context. Despite this, with regards to literacy, Sonbul and Schmitt (2010) claims that only applying language and vocabulary in a context does not allow learners' literacy skills to progress more than learners who only receive direct teaching. Sonbul and Schmitt (2010) emphasise the importance of combining direct and integrated teaching to support learners' literacy, numeracy, and digital competence progression, to which Donaldson (2015b) acknowledges that utilising direct and integrated teaching as a pedagogical principle. Therefore, in order to ensure learners' progression, the following tasks will entail learners applying and enhancing their previously developed literacy, numeracy, and digital competence skills within the context of another subject.

Activity 2 – Research

This activity continues to develop learners' DT skills of generating ideas for a product (DCELLS, 2008b). This activity entails learners using their interpretations of the data, the three most popular fruits, to research fruit smoothie recipes online. Learners will apply their digital competence skills of searching '*different keywords*' in order to find '*relevant information*', supporting learners' ability to select suitable websites (Hwb, 2019). Estyn (2018, p.25) states that effective schools create '*meaningful digital contexts*' for learners to apply their digital competence skills and suggests this develop learners' understanding. Similarly, Donaldson (2015b) and ACEL (2016) highlight the importance of creating authentic learning contexts as said contexts connect prior learning to real-life experiences resulting in memorable learning (Ebbinghaus, 1885; and DCELLS, 2008a). This suggests this activity will enhance learners' knowledge and understanding of their DT and digital competence skills. Once learners have selected a suitable website, the learners will be supported to question the reliability of the websites content. Donaldson (2015, p.29) recommends that a purpose of education in Wales' new curriculum should be for learners to develop as '*ambitious, capable learners*' who '*evaluate critically*' the information they have researched. This highlights the importance of developing learners' critical analysis skills. Rodriguez (2018) states that, when working independently and playing and active role in their learning, such as conducting research online, learners may become distracted by non-task related topics. Conversely, Pearce (2005, p.1) describes '*flow*' theory, whereby learners are completely engaged in the learning task that there is '*no room*' for distractive thoughts. Pearce (2005) suggests that creating tasks that set goals, timeframes, and appropriately challenge learners support the flow experience. Therefore, learners will be provided with success criteria, a completion time, and differentiated tasks to overcome this issue and ensure learners are fully engaged in the task (Pearce, 2005). Said success criteria will aid in the assessment of the learners' digital competence skills (Black and William, 1998).

Activity 3 – Recipes

Schlepppegrell and Go (2007) states teachers' exemplification of the connections between meaning and structure of writing supports learners' understanding of different types of texts and their ability to apply it within their work. Therefore, learners will examine the recipes they have researched and identify the structure and types of language and vocabulary used (DCELLS, 2016a). Additionally, in order to develop learners' cognitive thinking skills, learners must gather information, organise and form an understanding of said information, and apply said information and understanding in their own work (Thinking Classroom, 2018). This exemplifies this activity will develop learners' cognitive thinking skills as well as learners' literacy skills. The teacher will facilitate learners in suggesting why recipes may, for example, separate each instructional step onto a new line. Once learners have examined their recipes, the teacher will support learners in writing their own fruit smoothie recipes by conducting shared writing. This will develop and apply learners' literacy skill of writing with the purpose to instruct (DCELLS, 2016a). Additionally, it will develop learners' DT skill of developing a recipe for their product (DCELLS, 2008b). Shared writing facilitates the learning as learners are able to '*observe and analyse the language begin used*' and apply it within their writing, results in greater understanding (Milan, 2005, p.348). Donaldson (2015) states collaboration is an element of good teaching and learning and a pedagogical practice, implying that teacher-pupil collaboration is an element of good practice. Additionally, Estyn (2018) highlights that, in general, learners' writing skills are a weak aspect of their literacy skills. These statements reinforce the use of shared writing to develop learners' literacy and DT skills (Milan, 2005; Donaldson, 2015; and Estyn, 2018). After completing their recipes, learners will be provided with feedback for the teacher including ways forward and will be given the opportunity to re-draft their work (DCELLS, 2016a; and Black and William, 1998). Following this activity, learners will use their recipes to make the smoothies. This will develop a range of DT skills, such as conducting hygienic and safe food preparation, numeracy skills, for example measuring ingredients, and literacy skills, such as communicating effectively with their group members (DCELLS, 2008b, 2016a, 2016b).

Activity 1 – Visitor

Barnes (2015b) suggests that opportunistic cross-curricular approaches should begin with a shared experience, such as a class visitor. Therefore, in order to engage learners in the theme, 'Entrepreneurs', a local entrepreneur will be invited into the class. Estyn (2019) share the effective practice of inviting visitors into the classroom, suggesting said learning experience allows learners to develop their '*skills, knowledge and understanding highly successfully*' across the curriculum. Furthermore, research suggests that utilising an educational speaker supports learners' understanding and development of skills due to the speaker's advanced level of knowledge (Cox, 2019). The entrepreneur will discuss thee following:

- entrepreneurs that inspired them,
- entrepreneurs throughout history, including those from Wales,
- and key facts about the lives of the entrepreneurs and the way in which they were entrepreneurial.

This will begin to develop learners' historical knowledge and understanding and allow learners to '*identify significant people and describe events within and across periods*' (DCELLS, 2008c). The learning experiences will require learners to apply their listening skills, by listening to the speaker and showing their understanding of the key facts of each entrepreneur by making notes (DCELLS, 2016a). Nunan (2002) highlights that, for effective listening development, learners must be informed what types of information they are listening for. Therefore, prior to conducting the activity, learners will be provided with a template to scaffold the information they are required to collect. For example, learners must collect the following information: entrepreneur's name, date of birth, and type of entrepreneur. Black and Wiliam (1998) highlight this is an effective element for assessment for learning as learner understand the purpose of the activity and what is expected of them.

Activity 2 – Research

Barnes (2015) states opportunistic cross-curricular approaches allow learners to lead the direction of their learning. Therefore, learners will select an entrepreneur, introduced by the visitor, to conduct further individual research upon. Research suggests this will engage learners' interests and support their development of history and numeracy skills (Donaldson, 2015; and McCarthy, 2014). DCELLS (2008c) highlight the importance of learners asking and answering questions about the past, therefore, learners will write five questions they wish to find out about the entrepreneur. Learners will use said questions to inform the research they will conduct, applying the relevant key works to support the research of information and selection of relevant websites (Hwb, 2019). Learners will represent the information they collect using a timeline, as DCELLS (2008c, p.12) states that must '*use timelines to sequence events*'. This will require learners to apply and develop their numeracy skills, such as ordering whole numbers and reading and writing numbers up to 10,000 (DCELLS, 2016b). Research suggests that applying mathematical skills within a meaningful, real-life context supports learners' numeracy progression (Pound and Lee, 2010; Ebbinghaus, 1885; and DCELLS, 2008a). Once learners have collected all of the relevant information, they will return to their five questions and utilise their numerical reasoning skills to answer said questions (DCELLS, 2016b). For example, learners may have to find the difference between two dates in order to identify the number of years it took for the entrepreneur's business to become successful.

5 key questions

1. How many years did it take for the entrepreneur's business to become successful?
2. What year was the entrepreneur born?
3. How many years ago was the entrepreneur born?
4. How old is the Entrepreneur?
5. How old was the entrepreneur when they founded their business?

Activity 3 – Presentation

Theory suggests that encouraging learners to present and share their work with others increases motivation and develops confidence and literacy skills required in future life (Hayton, 2019; and Wyse and Dowson, 2009). Donaldson (2015, p.23-30) exemplifies this within his work as he recommends Wales' new curriculum allows learners to develop as '*confident individuals*' who are '*ready to play a full part in life and work*'. Therefore, learners will present their research to the rest of their group. Based on the principles of the opportunistic approach, learners will select the means in which they present their findings. For example, learners may develop their digital competence skills of modifying and presenting a range of text and images via a PowerPoint presentation or a poster (Hwb, 2019). During their form of presentation, learners will apply and develop their oracy skills of explaining information supported by the use of a resource (DCELLS, 2016a). In order to support learner's oracy development, the teacher will scaffold learners' responses using sentence openers, to which Alexander (2008) informs is a dialogue oracy strategy whereby learners apply sentence structures within their speaking to develop their understanding of the content and their oracy skills (Millard and Gaunt, 2018). This suggests that structuring learners' oracy presentations will develop their oracy skills and furthermore enhance their history skills of asking and answering questions (DCELLS, 2016a). In order to further scaffold learners' oracy presentations, learners' success criteria will include learners answering their five key questions, to with research suggests that allowing learners to understand what is expected of them and the purpose of the activity is a form of effective teaching and assessment for learning (Black and Wiliam, 1998; and Jones, 2005).

Conclusion

To conclude, the theme-based and opportunistic cross-curricular models exemplify the implementation of literacy, numeracy, and digital competence within a range of contexts. The overarching theme, 'Entrepreneurs', supports a purpose of Wales' new curriculum and provides a number of opportunities for learners to apply and enhance their previously developed literacy, numeracy, and digital competence skills in DT and history. Overall, the models support the connections between the cross-curricular responsibilities and the Areas of Learning and Experience through real-life contexts, developing learners' understanding and long-term memory of said skills (Pound and Lee, 2010; Ebbinghaus, 1885; and DCELLS, 2008a). The two models share a number of principles, such as applying skills in real-life contexts and integrating the teaching and learning of skills (Barnes, 2015b). Similarly, effective implementation of the two models require sufficient teacher knowledge of the pedagogical principles of the model, to which Estyn (2018) highlight is an area of development for a number of teachers in Wales.

Opportunistic cross-curricular approach

Barnes (2015a, p.75) describes how opportunistic cross-curricular teaching allows learners to '*dictate the depth and direction of learning*'. This indicates the approach will be underpinned by learners leading the learning. Research suggests learner-led approaches develop leaners' self-sufficiency, creative thinking, and ownership of learning (Tseng and Chen, 2010). Additionally, Donaldson (2015b, p.69) states that learners taking '*increasing responsibility for their own learning*', whereby learners are involved in planning processes, is a pedagogical principle. Estyn (2018) acknowledge many teachers fail to involve learners in the planning process due to the rigidity of their curriculum planning. This highlights the requirement of this model to allow flexible planning and support learners' development of the cross-curricular responsibilities.



Benefits and limitations

Barnes (2015b) states opportunist cross-curricular models encourage learners' curiosity and motivates their learning. Research suggests learner curiosity often increases self-esteem and achievement (Walker and Logan, 2008). Furthermore, Estyn (2019) shares the good practice of Ysgol Brynaerau who allowed learners to lead their learning via an opportunistic cross-curricular approach which resulted in learners' independence developing and having a concrete understanding of the work, and aspects of the cross-curricular responsibilities, they had developed and produced (Estyn, 2019). This implies opportunistic models developing a greater understanding of the skills, and increase self-esteem and achievement (Walker and Logan, 2008; and Estyn, 2019). However, Hayes (2010) questions the effectiveness of this model, stating it provides learners with opportunities to avoid areas they find challenging, to which Barnes (2015b) suggests this model requires confident and effective teachers to ensure activities develop relevant skills. However, Estyn (2018) query the effectiveness of teachers' planning of the cross-curricular responsibilities and states the cross-curricular responsibilities are not effectively embedded within all relevant aspects across the curriculum. These statements highlight that teachers require sufficient pedagogical knowledge of opportunistic cross-curricular approaches in order to ensure effective implementation (Barnes, 2015b; Hayes, 2010; Estyn, 2015; and Cochran et al, 1993).

Prior to conducting the activities, the following tasks will have been complete:

- Explanation of the purpose of the activity, whereby learners will create and sell a product in the forthcoming school fair,
- Generation of product ideas, developing learners' problem solving skills and limiting creative barriers to learning (Dewey, 1938; Runco and Acar, 2012),
- Conclusion of the final product learners will develop.

For the purpose of this work, the learners will create and sell fruit smoothies. Therefore, the cross-curricular approach will aim to develop learners' design and technology (DT), literacy, numeracy, and digital competence skills.

The Department for Children, Education, Lifelong Learning Skills (DCELLS) (2008b, p.12) state, in the DT curriculum, learners must '*use a range of sources to generate ideas for a product*'. Therefore, learners will generate fruit smoothie flavour ideas by conducting market research in the school. The learners, in groups, will collect data from a year group about their favourite fruits. Learners will apply their numeracy skills of representing data using a tally chart when recording said data (Figure 1) (DCELLS, 2016b). Research suggests that applying mathematical skills within a real-life context reinforces, enriches, challenges, and affirms learners' understandings (Pound and Lee, 2010; Ebbinghaus, 1885; and DCELLS, 2008a). This justifies the application of representing data using a tally chart to reinforce and develop learners' understanding. Estyn (2015) acknowledge that representation and interpretation of data skills are often a challenging area of numeracy for learners. This emphasises the importance of providing learners with opportunities to apply and develop this skill within different contexts in order to ensure progression (Pound and Lee, 2010). Once learners have collected data from a year group, they will share their data with other class members, therefore collating a large sample of data. The learners will represent said data using a bar chart (Figure 2) (DCELLS, 2016b). The teacher will model to learners the key elements of creating a bar chart, for example selecting units for an axis, in order for learners to observe the skills being conducted and recalling their prior knowledge (Eggen and Kauchak, 2001). Haston (2007) describes how, when used in inappropriate situations, modelling can inhibit pupils' learning. However, as noted by Estyn (2015), supporting learners' knowledge of data representation is essential. Once learners have completed their charts, the teacher will facilitate learners in interpreting the charts and concluding which three smoothie flavours the learners will make. Once again, the teacher will use a modelling strategy to support the learners (Eggen and Kauchak, 2001). Education Wales (2019, p.7) highlight, within the Mathematics and Numeracy Draft Curriculum for Wales 2022 document, that learners should use their collected data to '*support informed inferences and decisions*'. Therefore, this supports the decisions for learners to analyse and interpret their bar chart to support their fruit smoothie flavour selections.

