
AC 2012-4419: CONSTRUCTIVIST E-PORTFOLIOS: THE USE OF MEDIA IN THE COLLECTING AND EVIDENCING OF STUDENT LEARNING

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At present, Michael Crehan is investigating the value of the constructivist electronic portfolio on teaching and learning in the design and technology setting. This research area encompasses multi-modal learning, personalised learning, electronic portfolio infrastructure, and an analysis of student e-portfolios submitted in the design and technology setting. The research aims to identify the advantages of e-portfolios in the advancement of student learning in design and technology.

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Constructivist e-Portfolios: The use of media in the collecting and evidencing of student learning

Abstract

Lewis argues that there are a variety of generative cognitive processes that are more likely to occur in technology education than elsewhere in the curriculum¹. Design based Technology Education supports the development of higher cognitive thinking and problem solving skills, where students have the capacity to express their creativity and innovation through the completion of the artefact they design, manufacture, and report on². For effective higher order cognitive learning to occur students are encouraged to record and evidence their design evolution and development as the design journey progresses.

Many of the current assessment models adopted in Design based Technology Education inadvertently encourage students to adopt a structured, linear approach in reporting on design activities. This structured approach can often lead to reverse engineering of the design portfolio subsequent to the students' convergence on their initial design idea. The reverse engineering of portfolios places greater emphasis on the end-product and removes the focus from the design journey undertaken.

This study investigates a cohort of initial teacher education students (n=27) as they participate in a design-based module to solve a semi-open design brief. Throughout the design journey students were encouraged to simultaneously collect data which they felt was relevant in the communication of their capability and learning throughout the design task. This data was then presented through the use of a non-criterion referenced e-portfolio system. The usage of common media types emerged and are presented in relation to the four stages of Kolb's learning cycle.

The findings identify six predominant media types utilised by the students in the collection and representation of data which informed their final design outcome. These findings are presented under the four stages of Kolb's learning cycle and identify the occurrences of each stage throughout the portfolios. The manner in which students utilised different media at different stages of their learning is analysed and outlines the dominance of various media types to communicate various stages of student learning. This is of significant importance to Design based Technology Education as it outlines the importance of constructivist e-portfolios in addressing the linear design approach and allows for a clearer interpretation of students' learning. The evidence presented clearly demonstrates how students represented the various stages of learning through the media available which has significance for course designers planning to use electronic portfolios.

Introduction

Design based Technology Education is designed to provide students with greater levels of autonomy, increased problem solving skills and creativity combined with the opportunity to critically reflect on their own learning³. The importance of Design based Technology Education lies in its educational goals⁴. These goals are designed to equip students with a set of transferable skills, which will enable them to adapt to the technological and societal needs of the future. The goals of technology education must however look past the need to prepare students for a particular profession, and look to develop students who are technologically literate¹. In the Irish context, the National Council for Curriculum and Assessment (NCCA) state the goals of technology education as being “a distinct form of creative activity where human beings interact with their environments, using appropriate materials and processes in response to needs, wants and opportunities”⁵.

‘Technical Education’ has existed on the Irish curriculum since its introduction in 1885⁶. Upon its introduction, the goals of technical education were concerned with a vocational ethos where a practical skill sets were widely cherished. The fundamentals behind the development of technical education in Ireland were simple. In order to promote economic success and progression the development of a workforce with a strong practical skill set was required. However, in line with a global shift coupled with the changing needs of an economy recent years have seen a shift towards a design based model of technical education, where a transferable skillset coupled with technological literacy is desired. This shift is highlighted through the introduction of Technology as a stand-alone subject at Junior Certificate¹ in 1989 coupled with the more recent introduction of Leaving Certificate Technology and Design and Communication Graphics² in 2007. While these changes have been welcomed by many, much of the practical ethos of technical education still permeates strongly through Design based Technology Education.

A focus on specific content as opposed to the goals of Design based Technical Education has led to teaching towards the assessment specifications outlined in state examinations. Lewis describes this as the “standards movement” where educators concentrate on specific standards rather than the broader educational goals of the subject¹. This influence can be seen in students design project work where the evidence of student learning is presented in a design portfolio following the completion of a linear design process. Atkinson argues that for high level cognitive development to occur students should record their learning simultaneously to the design activity². This paper outlines the importance of portfolios for student learning and outlines how an electronic portfolio provides students with the opportunity to express their learning ‘in their own voice’ (ibid).

Portfolios in Design and Technology Education

Barrett and Carney ask the question “what is a portfolio?”⁷ The definition and purpose of a portfolio cannot be outlined solely to one profession or area of education. Instead it is important to recognise the diversity with which portfolios can be used in the gathering and presentation of information and work to others. However, the use of portfolios can be allocated to the following areas:

¹ Junior Certificate takes place from years 1-3 in second level education in Ireland.

² Design and communication Graphics (D.C.G) is a new syllabus which replaced the previously existing Technical Drawing Syllabus. D.C.G. was first introduced to main stream schools in Ireland in 2007.

1. Assessment
2. Records of learning outcomes
3. Collection of work for employment purposes

Paulson and Paulson identified that the strength of the student portfolio “was that it was a total learning environment that included assessment as one , but only one feature, albeit a central one. Within the context of a student portfolio, instruction and assessment coexisted in an extremely compatible manner” (pg.12)⁸. An educational portfolio contains material which “a learner has, collected, reflected, selected, and presented to show growth and change overtime.” (pg. 1)⁷ It can therefore be highlighted that the purpose of an educational based portfolio is to promote student-centred learning where students become constructors of their own meaning⁹. A portfolio for the Design and Technology classroom is a combination of a learning portfolio, an assessment portfolio and a working portfolio¹⁰.

The student portfolio in Design based Technology Education in Ireland has however become largely dominated by assessment. A utilitarian approach to the development of design portfolios in Design and Technology subjects, has led to the true meaning of the design portfolio been lost. Students’ awareness of external criteria prior to the development of their portfolios has created a culture where ‘positivist’ portfolios are the norm. Paulson and Paulson identified two opposing categories of portfolio, the positivist and constructivist portfolio⁸. The purpose of the positivist portfolio is “to assess learning outcomes and these outcomes are, generally, defined externally”⁸. The nature of positivist portfolio generation in the Irish technology education system is evident as it “assumes that meaning is constant across users, contexts and purposes”⁸.

In contrast, the constructivist portfolio affords an opportunity for learners to participate in a learning environment where they get to construct meaning⁸. The constructivist portfolio is a portrayal of learning which is “owned by the learner, structured by the learner and told in the learners’ own voice (literally and rhetorically)” (pg. 2)⁷. It is this type of portfolio which was adopted and used in the design module on which this paper is based. A constructivist portfolio was chosen as it places an emphasis on the selection of items which reflect learning from the students’ perspective. The students partaking in the module represented their individual learning experiences through the use of an electronic portfolio system. The objectives of a constructivist portfolio align with those of constructivist learning theory which acknowledge that each learner constructs an individual understanding of the world based on existing knowledge and experiences coupled with personal interests and goals¹¹.

Constructivist learning theory acknowledges and complements the understanding that “different factors come into play for different people and the same factors affect people differently”¹¹. This in turn leads to the understanding that if “two people read the same passage yet construct entirely different interpretations of its meaning”¹¹. To promote student learning and engage them in critical reflection on the important aspects of their learning a constructivist e-portfolio was devised. Constructivist learning theories like those of Gardner (multiple-intelligences) and Sternberg (Triarchic Theory) strive to develop a learning environment in which deep meaningful learning is evident. In order for deep learning to be elicited, students need to participate in exercises which promote learning for personal understanding and which allow students to construct meaning based upon their prior knowledge and experience. Beattie et al.¹² characterises the ‘deep approach’ as students who:

1. Seek to understand the issues and interact critically with the contents of particular teaching materials
2. Relate to previous knowledge and experience
3. Examine the logic of arguments and relate the evidence to the conclusions

In the removal of explicit criteria Kimbell et al.¹³ outlined that creative project work tended to be based on and focused by design driven ideas. In contrast it was found that projects which were deemed not to be highly innovative were generally based on a traditional linear approach to the design process. The removal of explicit design criteria complements the deep approach to student learning.

The work of David A. Kolb highlights the educational and learning significance of experiential learning. Experiential learning is grounded in the theory that education/ learning is not final, instead, “ideas are not fixed and immutable elements of thought but are formed and re-formed through experience”¹⁴. Drawing from the work of Piaget, Dewey and Lewin and through further investigation Kolb developed ‘The Experiential Learning Theory Model’. Kolb states that his model is an “idealised learning cycle or spiral where the learner “touches all of the bases” in order for in-depth learning to occur”¹⁵. Kolb envisages that for effective learning to occur learners need four different kinds of abilities¹⁴. As one aspect of the student portfolio is a record of student learning, the ability of students to represent these abilities through a design portfolio is central to the learning cycle.

Electronic Portfolios in Design and Technology Education

Electronic learning (e-learning) encapsulates a wide range of areas of learning from using the internet to research small items to participating in degree programmes taught through an electronic medium¹⁰. While the value of this learning is recognised it further shines a light on the use of technology in the classroom. Research indicates that students are increasingly becoming proficient in the use of Information Communication Technologies (ICT) in advancing their learning¹⁰. However, the potential of ICT to advance student learning has yet to be fully realised in the Design and Technology classroom. Kimbell et al.¹⁰ highlighted that there is little evidence to suggest ICT is being used by Design and Technology students in “reflecting, reviewing, critiquing and evaluating their ideas”. The work of Kimbell and his associates at the Goldsmiths College at the University of London continued to design and assess an electronic portfolio system in the Design and Technology setting.

An electronic portfolio (e-portfolio) is a modern variation of the traditional paper based model. Lorenzo and Itelson defined an electronic portfolio as “a digitised collection of artefacts including demonstrations, resources and accomplishments that represent an individual, group, or institution”¹⁶. Similar to traditional paper based models, e-portfolios provide students with the opportunity to engage with their learning and critically analyse their thinking¹⁶. However, an electronic portfolio has greater scope to allow students represent their learning through the full range of digital media¹⁷. This scope enables student to select a form of media which best allows them to portray their learning. This multimedia scope presents students with the opportunity to capture, construct and evidence their capability and learning throughout the design activity⁹.

A central aim of an e-portfolio should be the critical engagement of students with the design task they are completing. It allows students the opportunity to track and highlight their

learning as it takes place. This unprompted capturing of the design activity allows students to document their learning as it happens. Reporting on the design process in this way removes the “post-task burden on learners to reconstruct a sanitised account of the process”¹⁰.

Method

Approach

This study is based on analysis of electronic portfolios generated by students participating in two initial technology teacher education programmes at the University of Limerick. These are the Bachelor of Technology in Materials & Architectural Technology (Ed) and Bachelor of Technology in Materials & Engineering Technology (Ed) concurrent teacher Education Programmes. These initial teacher education programmes facilitate student teachers in the development of skills necessary to become an effective teacher of technology subjects at post-primary level. The paper investigates the relationship between media usage in student e-portfolios and the content collected by student to represent their learning

Participants

The focus of this study is on the year one students participating in both of the Initial Teacher Education (I.T.E.) courses outlined previously. As part of the syllabus for semester two, year one, on both of the I.T.E. programmes students are required to participate in two core skills development modules in the subject areas of woodwork and metalwork. These modules are a progression from subjects previously studied during semester one. In semester one students participating in the Bachelor of Technology in Materials & Architectural Technology (Ed) (Construction) course undertake laboratory based basic skills development modules in both metalwork and woodwork, whilst their counterparts participate solely in the metalwork module. Nevertheless, in semester two both groups of students participate in a further two modules in woodwork and metalwork. Both of these modules share a common educational philosophy where pupils are required to participate in a six week front loading of knowledge and skill. On completion of this task the students are required to develop and further their knowledge and skills through a six weeks design-based project.

Design

The design-based project which the students are tasked with completing comprises of a number of important features:

1. The students are issued with a semi-open design brief
2. Students must produce a physical artefact
3. Students are required to evidence their learning through the use of an electronic portfolio system
4. The generation of the electronic portfolio is non-criterion referenced

The students are issued with a semi-open design brief which outlines the requirements for the design project. The brief requires the students to design and make an A4 sized scene which captivates an un-specified emotion. The chosen emotion may or may not relate specifically to the individual. Furthermore, the students are required to create a ‘flower’ which complements the designed scene and which portrays the chosen emotion without the use of facial expressions. Concurrent to the design and manufacturing process, the students are required to generate a non-criterion referenced electronic portfolio (e-portfolio). The aim of

the e-portfolio is to track and highlight the learning which took place for an individual student throughout the completion of the project work.

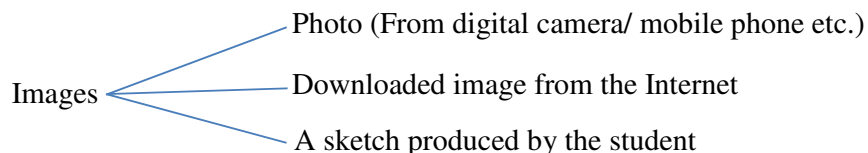
One hundred and forty students submitted an electronic design portfolio as part of their coursework. A sample size totalling twenty seven e-portfolios was selected and analysed for the purpose of this paper. The e-portfolios were analysed in relation to media usage across the four stages of Kolb's Learning Cycle. The analysis of the e-portfolios took place through two main phases.

Phase One:

Phase one involved the selection of an un-stratified sample of students to allow for the classification of Kolb's cycle of experiential learning in the portfolios. Upon developing an appreciation and understanding of the complexities involved in analysing design portfolios using Kolb's cycle the portfolios were further analysed in order to categorise the media types used in the production of the design portfolios. This exercise involved establishing the occurrences of varying media across the four stages of Kolb's cycle. Through this work four main categories were clearly identifiable;

1. Text
2. Images
3. Audio Files
4. Videos

However, in order to provide greater clarity it was decided to add sub-categories to 'images' as follows:



Phase two:

Phase two involved the analysis of a further sample of twenty two student e-portfolios. Using the framework which was established in phase one an additional un-stratified sample of twenty two portfolios were analysed. This process was completed using e-portfolio submissions from the same student cohort as the sample in phase 1. The results of this task were completed and are presented in the next section.

Results:

The results section of the paper outlines the extent to which various media were used in the representation of student learning through the holistic electronic portfolio (Figure 1). The findings present the use of media in terms of Kolb's learning cycle. This allows for comparison between the types of media used by students to collect and evidence their learning versus the stage of learning which was occurring. The results highlight the dominant types of media used by students to portray different types of learning when completing a design-based task.

Phase one of the research methodology outlined the selection of a random sample of student e-portfolios to allow for the classification of Kolb's cycle of experiential learning. This

initial sample comprised of five e-portfolios which presented the following examples as representing the four stages of Kolb's learning cycle as interpreted by the researcher.



Figure 1- An example of a student's e-portfolio

Reflective Observation:

Presented in the following section is qualitative data exploring students' reflective work. This is represented through student comments extracted from the electronic portfolios. In addition, Figure 2 presents a post from the e-portfolios which highlights the use of various media types in representing Reflective Observation.

Student 2: "Have you ever found you're self in the position where things aren't going well and you're not in a good place. Could be work related, family issues etc. and no one else can help no one can take you out of that place. This is what my project is based around."

Student 3: "Overall I have to say I was pleased with the quality of work but if I was remaking the project there a number of things that I would definitely do differently."

Student 5: "When considering the design brief I felt that in order for the project to come together as a whole (rather than several separate artefacts) I should operate with some purpose."

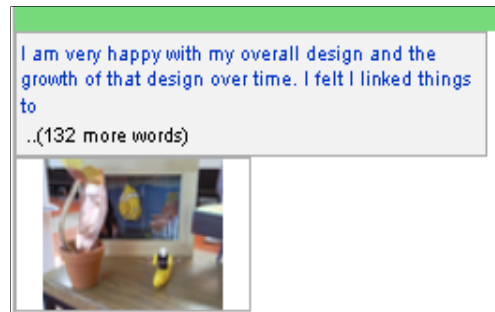


Figure 2- A pane from a student's portfolio highlighting the use of various media types in Reflective Observation

Abstract Conceptualisation:

The following section explores the area of Abstract Conceptualisation through student comments extracted from the electronic portfolios. In addition, Figure 3 below presents a post from a student e-portfolio which highlights the use text, audio and image based media to represent Abstract Conceptualisation.

Student 3: "My very first idea was of a man fishing at a river side. My second Idea was of a man skiing and my last idea that I felt was feasible was on the man with the rifle."

Student 5: This is a partial screen snap of a student portfolio which highlights the use of voice files coupled with images which have been downloaded from the internet.

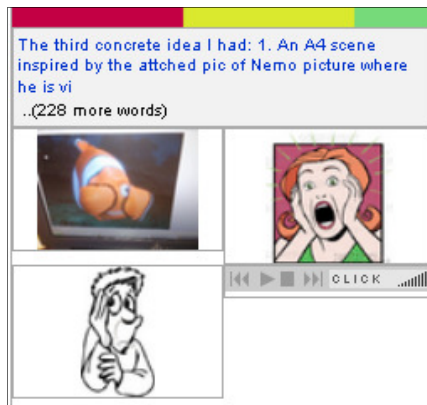


Figure 3 - The use of various media types in representing Abstract Conceptualisation

Active Experimentation:

The area of Active Experimentation in the students' electronic portfolios is presented through the following student comments and posts taken from individual students' e-portfolios. Figure 4 and Figure 5 below provide a sample of students' work which illustrates the use of text, images and sketches across the student work.

- Student 1: The model shown in the picture is cut out of cardboard.
- 1: The sun will be made out of copper. Spun and then planished for effect.
 - 2: The sky and the background cliffs will be veneered. The cliff in the foreground will be fretwork with veneer on top of it.
 - 3: The coyote will be etched out of copper.
 - 4: The road runner will be enamelled.



Figure 4 - The use of various media types in representing Active Experimentation

Student 4: "I decided on mahogany for the carved piece as it would best show off the head of the beautiful woman I intend carving, also because mahogany stands out from other timbers"

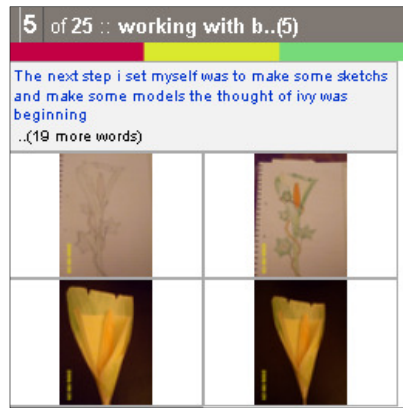


Figure 5 - The use of various media types in representing Active Experimentation

Concrete Experience:

Presented in the following section is qualitative data exploring student evidence of concrete experience. This is represented through student comments extracted from the electronic portfolios. Furthermore, Figure 6 presents an image taken by student 2 to represent practical experience in the laboratory setting. Figure 7 presents 2 posts from the e-portfolios which highlight the use of various media types in representing Concrete Experience.

Student 1: “The frame for the A4 scene is screw fixed with beading on the inside. The frame was first sanded down. I then marked out and bevelled the edges. I sanded down again. Then I stained the frame with oak wood stain. When the stain was dry, I varnished it with an oil based clear varnish. When that was dry I rubbed the frame with wire wool and finished the frame off with bee wax.”



Figure 6 - An image taken by student 2 to represent practical experience in the laboratory setting

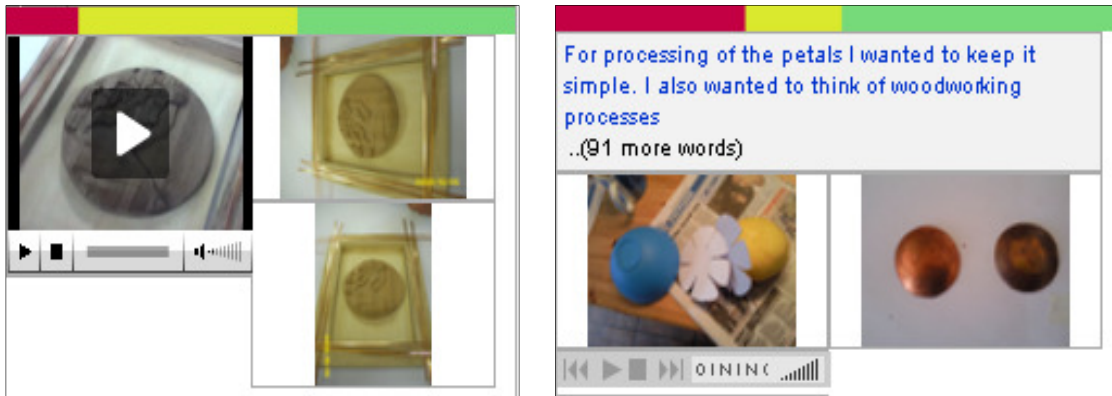


Figure 7 - The use of various media types in representing Active Experimentation

Having explored examples of students learning and various types of media used by students in representing their learning the following section explores in more detail the use of media across the selected portfolios

Media usage

The sample of 27 e-portfolios produced in total 1,912 media occurrences across the six media categories established. Dominance in the use of text based and photo based media was evident throughout the majority of e-portfolios analysed. This dominance is clearly evident in Figure 8 below, which graphically demonstrates the breakdown of media across the entirety of the sample.

Media Occurences

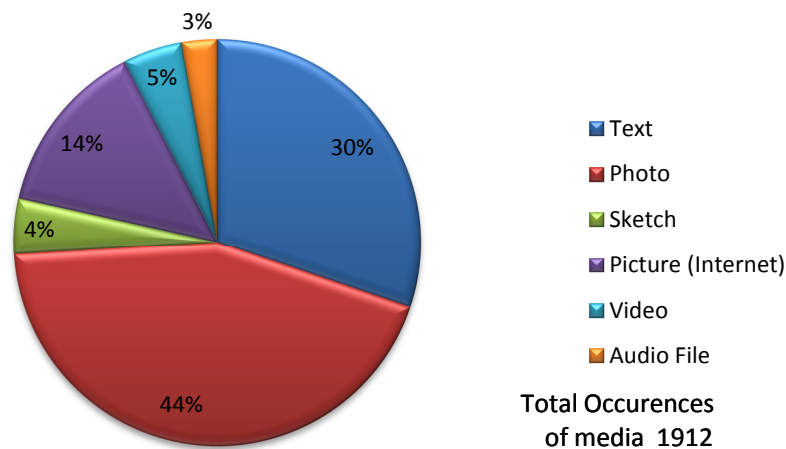


Figure 8 - Media occurrence across the sample

In the following section Figure 9 to Figure 11, breakdown the 27 individual portfolios and highlight the percentage of each media individual students' used across their portfolios. It is notable that 26/27 e-portfolios displayed a variety of media, while student 17 chose to use text solely in the portrayal of his/her learning.

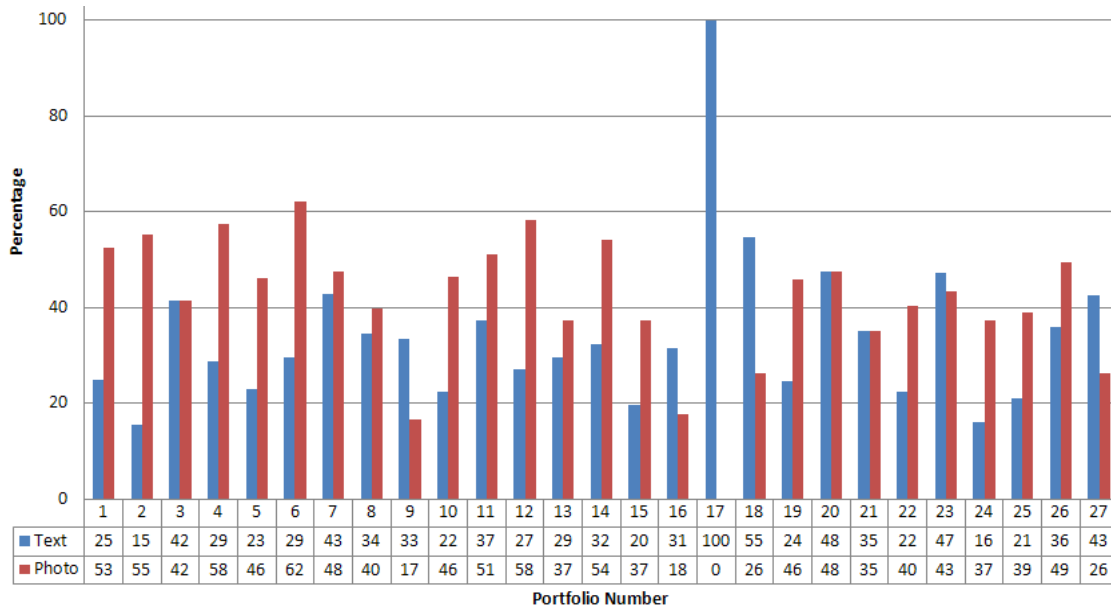


Figure 9 - The occurrence of text and photos across the sample

A strong reliance of text and photo based media across the portfolios is evident (Figure 9). An average portfolio portrays text and photos 34% and 41% of the time respectively. As previously stated it can be seen that student 17 used text solely as a means of representing his/her learning.

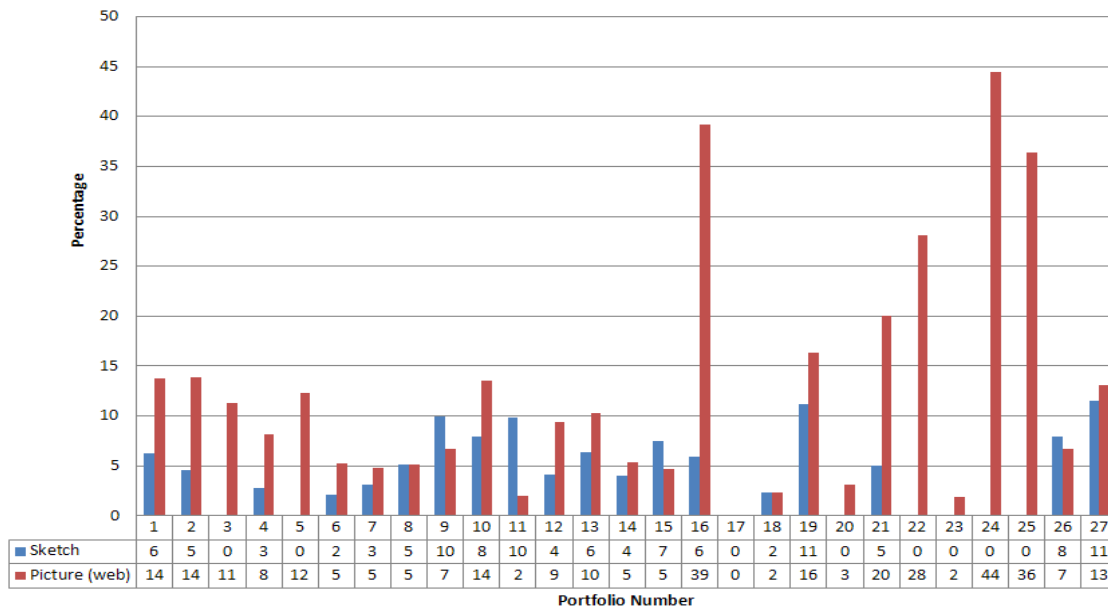


Figure 10 - The occurrence of sketches and pictures (web) across the sample

The use of sketches and web based pictures across the student portfolios is highlighted through Figure 10 above. A reduced reliance on the use of these media is evident. A number of students were deemed not to have used any sketching while all students (except student 17) were seen to have used pictures from the internet in the generation of their design portfolios. An average portfolio was seen to demonstrate sketches and web based images 4% and 13% of the time respectively.

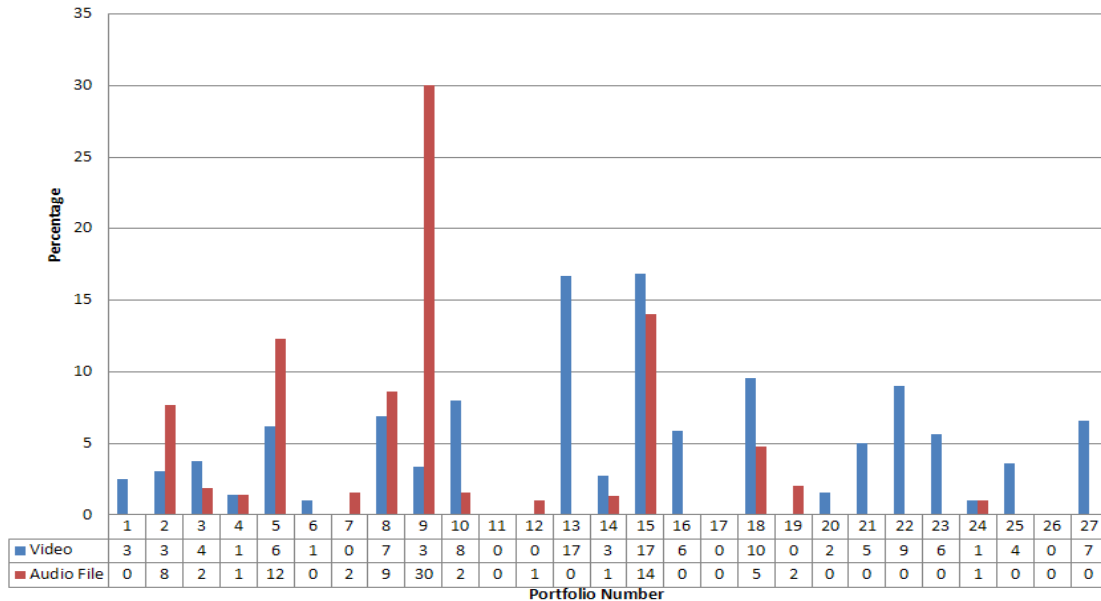


Figure 11 - The occurrence of video and audio files across the sample

Figure 11 above presents the use of video and audio files across the 27 e-portfolios analysed. As visually evident there is little evidence of balance between the students use of the media. Students tended to rely heavily on one of the two media types. In contrast, student portfolios 8, 15 and 24 can be seen to have used video and audio files in a balanced way across the portfolios. Video files were used 4% of the time while Audio files appeared 3% in an average portfolio.

Analysis of media occurrence vs. Kolb’s Learning Cycle

In order to understand the preference of students for varying types of media across different areas of their learning a comparison between the media results outlined earlier and the students application of Kolb’s experiential learning cycle was drawn. This demonstrated the dependence of student’s use of various media across various tasks. Figures 12 to 15 below outlines the percentage use of media for each stage of Kolb’s learning cycle and the level to which each of the various media types were used in each stage of the student cohorts learning.

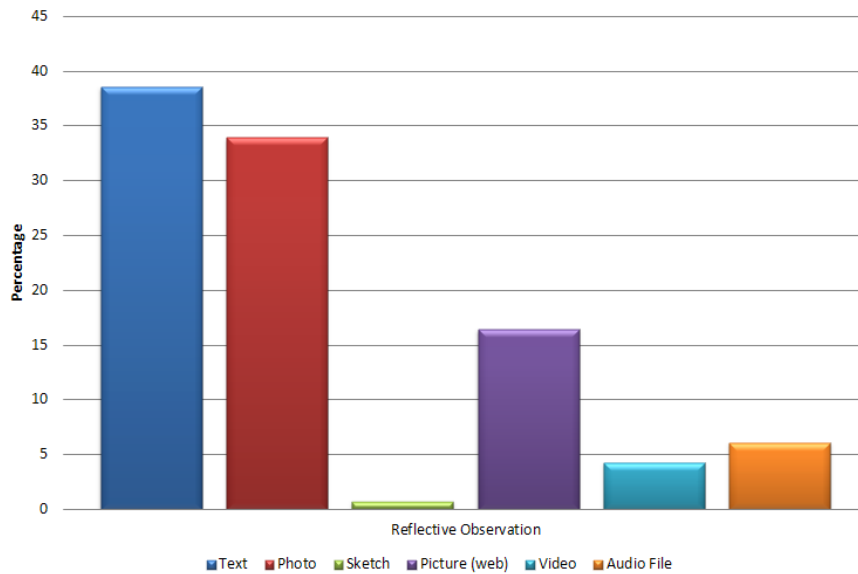


Figure 12 - Media occurrences versus Reflective Observation

As students presented reflective thought through their design portfolios their reliance on different media varied greatly, as illustrated in Figure 12 above. This evidence presented indicates that as students reflect on tasks their preference is to use text and photo based media. However it is interesting to note that the use of audio and video files was greatest as students engaged in reflective tasks.

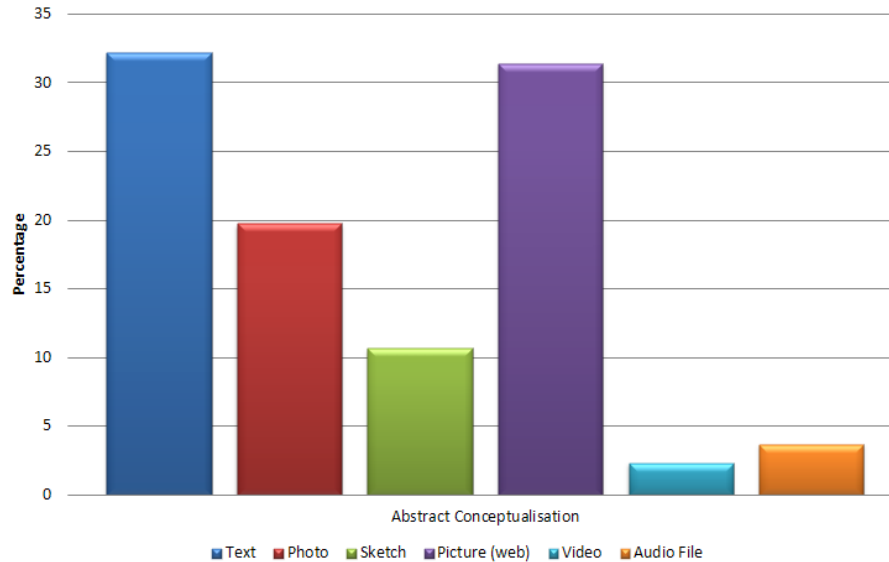


Figure 13 - Media occurrences versus Abstract Conceptualisation

A significant change in the use of media occurred as students engaged in abstract thought throughout the design portfolio. Figure 13 above illustrates the types of media used by students when engaged with the Abstract Conceptualisation stage of their learning. Students reliance on the use of text and photos reduced while there was a significant increase in the use of sketches and web based pictures. It was observed throughout the analysis of the e-

portfolios that as students sought inspiration and as ideas were generated their expression of internal thought manifested itself through the use of external media.

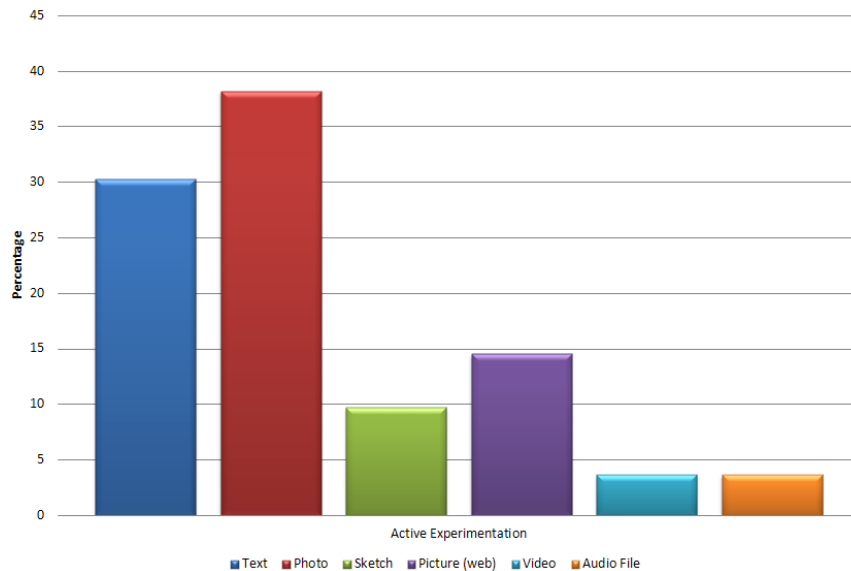


Figure 14 - Media occurrences versus Active Experimentation

As students experimented with various materials and processes throughout the design process their use of media to portray their work changed, as illustrated in Figure 14. An increase in the use of digital photography coupled with a decline in the use of web based pictures indicates the students move from internal thought to external representation of that thought.

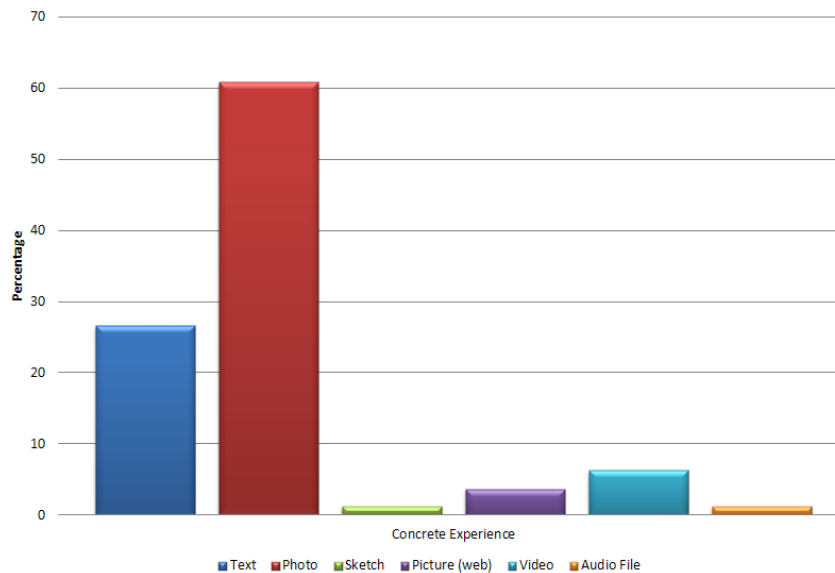


Figure 15 - Media occurrences versus Concrete Experience

Figure 15 indicates students' use of media to represent their concrete experiences. A significant reliance on the use of digital photography can be seen as students recorded their

practical experiences in the laboratory. It is also interesting to note how students significantly reduced their dependence on sketches and pictures from the internet when engaged in this aspect of their learning. However, this can be expected as students externalise their thought process in the laboratory setting.

When all four graphs (Figures 11 to 15) are analysed together some interesting results can be seen. The use of text throughout all stages of learning was relatively unchanged. Similarly, the use of photo based evidence remained high but fluctuated depending on the stage of learning students were engaged in. However, the remaining media types did not show the same dominance throughout the entire learning process.

Discussion

Kimbell sees the design portfolio as a medium where the designer “has a conversation with him/herself through the medium of the portfolio.”¹⁰ The purpose of the student design portfolio is to promote the documentation and recording of student-centred learning. It is a channel of communication of the design journey rather than the reporting of an externally structured story, for the purposes of assessment or reward. Once the requirements of external criteria have been removed the student can portray his/her learning in a means that they feel best suits their design journey. The essence of a portfolio is to provide pupils with a medium to collect, reflect, and report on their learning. The results presented in this paper have analysed how students collect information to represent various stages of their learning as they proceed through the design journey.

The non-criterion referenced student-centred approach adopted in this study provided students with the opportunity to become autonomous learners and thus gain ownership of their own learning. Previous studies have shown that students “embraced the concept of removing external assessment criteria and the defining criteria that are applicable to their design solution”.⁹ However, it was unclear whether the use of an electronic portfolio promoted or restricted the documentation of this student learning. This study has highlighted the potential of an electronic portfolio in the documentation of student learning alongside the learning process. Traditionally students are encouraged to perform these tasks together, however, in the Irish context the National Assessment Strategy does not allow for the use of e-portfolios.

Learning is a divergent process, where each student constructs meaning on an individual basis. As anticipated significant variations in the use of media was found across the students’ design e-portfolios. The various types of media used by students when completing various aspects of their learning is quite evident from the work outlined above. Students performing reflective tasks chose the use of static photos and text predominantly as a means of representing their learning (Figure 12). Often these tasks involved reflection on finished items of work where flaws, strong points and future considerations were represented in the student portfolios. Student reflection also centred on life experience and motivational aspects of their learning coupled with intrinsic reasoning in the pursuit of a solution. Each stage of the learning process can be seen to be dominated by one or two types of media. As stated, Reflective Observation was largely dominated by text and static photography while abstract thought was predominantly represented through the use of images downloaded from the internet and text files outlining students thought processes. This use of external media represents a search for external imagery in the formation of new ideas. This is interesting as the use of images downloaded from the internet dominated the use of sketching (Figure 13).

As ideation sketching is considered a core aspect of the design journey, it is interesting to note students heavy reliance on external media during the design generation.¹⁸ Furthermore, Figure 10 indicated that a number of students did not indicate the use of any sketches throughout their portfolios. Abstract thought largely centred on the generation of design ideas and also the solution to problems derived throughout the course of the learning process.

Experimentation with design ideas and solutions to problems encountered presented students with the opportunity to explore the use of various materials and test numerous solutions to a problem. This area of the student learning was represented more visually than segments outlined earlier. Static imagery proved prevalent in the representation of this aspect of the students learning with students choosing to represent their solutions to problems and early experimental examples through the use of photos. It is however noticeable that out of the 27 student e-portfolios analysed four students were deemed not to have represented any experimental activity in their learning (Figure 14). Concrete experience in the learning process in the most part involved the generation of physical artefacts. This process largely took place in classroom workshops (laboratories) where student documented their learning through the dominant use of digital photography. Figure 15 above graphically represents the dominance of this media in portrayal of this aspect of the student learning process.

When interpreting the sample as a whole, a strong reliance on the use of text (30%) and digital photos (44%) is largely evident. The reason for this is not apparently evident. However, one hypothesis lies in the structures of formal education, where information is largely presented to students in the form of textual and graphical media. Is it necessary for us to rethink what it is we teach in Design and Technology Education and how we teach it? Would promoting and encouraging the use of non-traditional media support a better type of learning? The integration of a non-criterion referenced constructivist electronic portfolio into a design module has provided a valuable insight into the learning of students through a design process. Equally it provides clear evidence to support the use of an electronic portfolio in supporting student exploration and learning. The use of digital media (videos, audio files etc.) by students in the capturing and portrayal of their learning indicates an advantage in the use of e-portfolios over traditional portfolios.

Conclusion

Constructivist portfolios are designed to facilitate students with a medium through which they can collect, reflect and present their learning. The paper has outlined the use of media in the collection and representing of student learning through and electronic constructivist portfolio. From the research conducted it has been identified that students portray their learning through various different media depending on the stage of learning which they are engaging with. The use of a constructivist e-portfolio enables students portray their learning in a manner which they have deem appropriate. Furthermore it allows the learner to gain ownership over his/her learning. Additionally, it allows students to tell their story in their own voice. A further body of work needs to be conducted into the effect which an electronic portfolio has on learning. The relationship between electronic portfolios and how students' reflect and present their learning is of interest to the researcher and it is envisaged that through future research the answer to some key questions surrounding the value of electronic portfolios will be provided.

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