

A Study of Interactive Digital Media as a Learning Resource for Young Learners in Museums.

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Summary

This study looked at the application of Interactive Digital Media in museums in an educational context for young learners aged 8 to 15. To analyse how Interactive Media could be effectively applied as a learning tool in museums this study used a literature review to analyse how museums operate as places of learning and the strategies and underlying pedagogies they put in place to maximise this learning. Further analysis identified the prevailing research on Interactive Digital Media in Museums which established that effective Interactive Digital Media was contingent on careful and thoughtful application based on number of factors such as pedagogy, resources and staff knowledge.

A qualitative framework was created based on George Heins "Museum Educations Theories Model". This model was chosen as it incorporated many of the pedagogical themes found in the literature review that were found to be conducive to effective learning. It was further suitable as it specifically designed to be applied to museums. It was compared against the education programmes of two museums, the British Museum and Irelands National History Museum: History and Decorative Arts. It was found that in the case of the British Museum, digital resources were applied effectively to create improved learning outcomes by being used in tandem with strategies that strongly identified with the criteria laid down by Hein. In the case of the National Museum of Ireland: Decorative Arts and History it was found that Interactive Digital Media was scarcely used, however many of the constructivist ideas within the framework were present and so a solid foundation existed for the successful implementation of Interactive Digital Media in the future.

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Chapter One: Introduction

In recent years new forms of media have heralded rapid changes across society and museums have not been immune to these same ripples and waves. Interactive digital media has begun to proliferate in museums in across the world. It's appearance in museums has come in many forms though but most often to entertain and engage guests. Recently though Interactive Digital Media has begun to be adopted by museum practitioners working in the education sectors of museums and is becoming more and more common as an educational aide.

This research paper will set out to examine the use of Interactive Media as an educational aide in museums and determine the benefits or otherwise of it's use.

These changes have been met with much analysis and contemplation and slowly a consensus has emerged that Interactive Media can be beneficial as an educational tool when used through considered and effective application but too much might even be detrimental to learning outcomes. (Gretchen Sullivan Sorin, 2013) (Jenny Kidd, 2014) (Falk and Kierking,2013).

What exactly is considered and effective application though? We must consider that the application of IDM is part of a wider series of choices that make up the learning strategy of a museum. In order to investigate the use of Interactive Digital Media it is therefore important to see exactly how it is applied in a museums educational setting and does it application then produce results that can be said to further learning. This leads to another question. How exactly do we define learning in this very specific context?

To answer this, I will look at different pedagogies used most commonly by Museum practitioners to detriment he most effective way of producing beneficial learning outcomes.

This will let us define how Interactive Digital Media can be applied effectively and then we can apply that criteria to two case studies to evaluate the use of Interactive Digital Media.

Chapter Two: Literature review

This literature review will be divided into three sections. It will look at the evolution of the role of education in museums, prevalent pedagogies in museums and finally the implementation of interactive digital media in museums, in an educational context.

Evolution of the role of Education in Museums

Glaser and Zenetou (1996) characterised the evolution of museums in the late 19th and early 20th century in America as “The emergence of the educational museums”. Moving away from the prevailing role of museums at the turn of the century as repositories of objects, American Museums gradually evolved to become public institutions, thanks to the influence of British museums, private benefactors and the increased mobility of the American populace thanks to the automobile. (Glaser and Zenetzou,1996).

The idea of Museums as places of learning developed with the rise of children’s museums and hands-on centres in the early twentieth century, which coupled with advanced research into the development of educational psychology led to the transformation of museums into “active learning environments” (Coehello Studart, 2000: 29). From 1950 onwards, the concept of museums with a formal learning mandate began to emerge. Museums educational output began to evolve from object-teaching and school visits to providing more comprehensive and rounded educational resources. (Kotler & Kotler, 2000. Rensselaer, 2008). These ideas were and still are, primarily restricted to museums in the First World. The extent of educational output in many developing world museums only goes as far as students perusing objects and reading the information tag without any meaningful learning. (Hein,2004) In this regard it can be said that the literature review focuses primarily on museums in the first world, particularly the United States and Britain. Both countries have a strong and extensive history of promoting their Museums and in 2017, 11 out of the 20 most popular museums in the world were in Britain and the United States. (Theme and Museum Index, 2017)

The United States has been at the forefront of advocating education within its museums. Most museums in the United States had the advantage of starting out as public institutions whereas their European counterparts were derived from royal collections and accumulations of historic objects. (Weller, A.1985.) In 1984 there were nearly 5000 museums in the United States. Their annual operating expenses approached one billion dollars. More Americans attended cultural events than professional sports events. (Weller, A. 1985.) The American Alliance of Museums was established in 1906 and they produced two seminal reports in 1984 and 1992(American Association of Museums, 1984, 1992) which emphasised the value of museums as educational institutions. (Anderson, D.19997) The role of educators in a museum is now so entrenched that a 2013 report from the AMA on the future of education in museums is enlightening. It focuses less on advocating for education within museums as previous reports had but instead focuses on topics as diverse as “the challenge of scaling up” and the role of communities in the curriculum. (Centre for Future of Museums,2014).

The U.K has also always had a well-established Museum culture. In 1931 , the Board of Education published a memorandum called ' Museums and Schools: Memorandum on the possibility of increased co-operation between public museums and public educational institutions' with guidelines describing diverse examples of collaboration between museum and schools , such as loans of exhibits , provision of information for teachers , school visits (Coehelo Studart,2004) but it wasn't until the 1990s that it too began to see education as an inherent function of its museums. David Anderson's report A Common Wealth: Museums in the Learning Age in 1997 (Anderson 1997) was a UK-wide review of museum education that saw formal and informal learning as a lifelong process and museums as having a powerful role to play in community development. The same report also highlighted the inadequate resources and focus by these Museums on education. (Anderson. 1997.p 3)

Closer to home, the history of museums in Ireland is inevitably bound up with its colonial past and the politics of a newly independent state. Concurrently, in the twentieth century, development within the cultural sector could be directly linked to the state's often dire economic situation. Marie Bourke has laid out the evolution of Irish Museums very comprehensively in her book, The Story of Irish Museums 1790-2000: Culture, Identity and Education. Irish Museums were pre-occupied with the politics of their colonial relationship

at the turn of the 19th Century and even after achieving independence suffered from a chronic lack of funding in the first half of the twentieth century due to “the cultural isolation of Ireland from 1922 to the 1950s and to the conservative nature of the people, as well as lack of interest at Government” (Bourke, Marie.2002). In the mid-1970’s specialist education staff first began to be employed and in the 1990’s increased investment also saw a large increase in the appointment of education officers across Ireland. The Irish Museums Association was set up in 1979 and the Arts Council released several reports on education in the Museum Sector, (Benson: Arts in Education, 1979 and Art and the Ordinary The ACE Report, 1989.)

So, while the concept of education in the Irish museums wasn’t completely absent from the discourse, it was always at a less mature phase than its international counterparts. The 1990s being a prime example, where outreach and funding for staffing were the priority in Ireland, prevalent international conversations focused on methodology or the increased use of digital media.

Current Irish Museums still must catch up with their international contemporaries. In a 2016 survey of Museums by the Irish Museums Association, the authors found that the effects of significant cutbacks were still being felt (Irish Museums Association,2016). Museums identified “(1) capacity (staff, volunteers, time); (2) funding and fundraising support; (3) buildings and storage” as priorities. Operating under these constraints it’s scant wonder that Irish Museums haven’t placed the same emphasis on digital media as their international counterparts and so it barely registers on the list of concerns within the report. The most relevant recommendation states that;

“We recommend additional training and resourcing be offered in the areas of digitisation and the development of digital and online strategies, including enhanced collaboration with colleagues working in the library, archives, and digital humanities.”(IMA,2016 p.11)

The lack of any digital strategies in 2016 would indicate how low of a priority IDM is to most Irish Museums. Further analysis shows that only a third of Museums that responded had a dedicated education officer. Having said that, the nature of Irish Museums should be considered. In some cases, the Museums are catering to very small visitor numbers or have

a small number of staff members to begin with. The report though shows at least the low priority, even amongst the most prominent Museums, given to Interactive Digital Media.

As such many of the examples and innovations we will see, and study will take place within the first world and primarily Britain and the United States given their prominent position in the Museum world.

We see that from the 1990s there has been an increasing acceptance that education, and educational professionals, are a prerequisite for the fulfilment of a museums public mandate. As external recognition emerged, internal educational debates came to the fore amongst educational practitioners. Museums have struggled to agree on a consensual framework for learning, being hampered by “confusion over the use of keywords, disagreement about appropriate goals and outcomes, and lack of an underlying educational theory.” (Ansbach, Ted. 1998 p286). Another issue that has come up has been how to assess and measure educational programs and initiatives. Falk and Dierking see this as a natural product of the learning process itself. "The strongly contextual nature of learning is one reason the learning that occurs in museums is so difficult both to predict and to assess... learning outcomes are always relative to the individual and the unique circumstances in which they occur." (Falk & Dierking, 1995 : 12).

These debates have gradually coalesced around the use of different pedagogies in Museums, their effectiveness and relevance for Museum studies. So the following section will look at how different pedagogies for museums have been analysed.

Pedagogy in Museums

There are many learning theories and pedagogies that span the subject of museum education theory. Interactive Digital Media though finds a natural bedfellow amongst constructivist theories of learning. The medium and the theory are linked by the process of the interactive experience. Jenny Kidd says “‘Interactivity’ has been central in attempts to engage children and young people within museum spaces for many years, not least because of the roots of that principle in philosophies of experiential learning and constructivism.” (Kidd,J.2014. p103) Museums and museum practitioners don’t adhere strictly to one learning methodology. Likewise, Digital Media in and of itself is not necessarily tied to any

learning theory, Jenny Kidd posits that in fact all museums, with all kinds of approaches, are full of media. Yet the idea of interactivity in a museum context, through digital media or likewise, has been deployed in a manner that strongly identifies with constructivism.

In the context of a Museum, constructivism has found a natural home in many ways. Falk and Dierking (2011. p 114) believe that "museums are excellent environments for meaningful learning because they offer rich, multi-sensory experiences". Interactivity is the key to bridging the gap between the knowledge museums offer and a fulfilling learning experience. Jeffery Clay believes that "to create a truly constructivist setting, museums must develop exhibits that get visitors involved, relating to them, to their lives, and to their past experiences". He feels that;

"Museums are ideal constructivist learning environments. They allow visitors to move and explore freely, working at their own pace. They encourage group interaction and sharing. They allow personal experience with real objects. They provide a place for visitors to examine and expand their own understanding." (Jeffrey-Clay.1998. p 7)

Aside from its role in Museums, Constructivism is a very popular educational theory which posits that we all uniquely construct our own knowledge. Constructivist theory holds that prior knowledge is of primary importance. As opposed to seeing learners as a blank canvas, constructivists see learners full of knowledge through which they distil new information, informing how they process that new information and creating links between the two. Learning occurs when existing conceptual structures connect with new ideas to form new concepts. For this to happen, learning must be "active". The learner must be actively participating in the discovery of this new knowledge by engaging in meaningful way with the new information and consciously linking it to their prior knowledge. Constructivism is huge topic with a wealth of literature dedicated to it and a variety of subdivisions amongst theorists and practitioners.(Phillips,1995) However, narrowing our focus to its application within museums, theories of active learning and human cognition have had a considerable influence generally in museum education and in the design of exhibitions for children and are still used today to provide a theoretical framework for research in museum learning and in the design of informal educational museum environments. (Stuart, 2000).

Active Learning

Piaget is viewed as one of the founding fathers of constructivism and his most relevant theories relate to the construction of knowledge through activity. He says;

“knowledge does not result from a mere recording of observations without a structuring activity on the part of the subject. Nor do any a priori or innate cognitive structures exist in man; the functioning of intelligence alone is hereditary and creates structures only through an organization of successive actions performed on objects.” (Piaget, 1980, p.23)

Piaget suggests that learning is an active process in which interaction between the environment and the individual played an influential role in the formation of internal organizing frameworks, which Piaget called cognitive schemata. The schemata were constantly changing and being refined as the individual learned new things, and the changes occurred in a predictable developmental sequence. Individuals interacted with each other and with objects and events in their environment, actively constructing meanings and creating movement from one stage of development to the next. So, for museums this means creating resources that engage students to allow the process to occur.

Piaget also indicated the importance of familiar situations in the arousal of children’s attention and concentration, which are important pre-conditions for learning. Children show more concentration in performing tasks in familiar settings, where they can feel comfortable and relaxed. In these environments, children’s attention increases. Museum education workers have outlined the relevance of orientation sessions and repeated visits to museums to help children become familiar with the environment (Hein, 1991) . According to Bagchi & Cole, Piagetian theory can also influence exhibition design as it can: "enable children to see clearly and immediately the effect of their actions ; encourage problem solving by posing a challenge or problem that is solved by making something happen ; and encourage children to create relationships among events and objects" (Bagchi & Cole, 1992 : 99) .

Social Learning

The second strand of constructivism that strongly informs Museum studies is known as Social Constructivism. Composed of Vygotsky's Social Development Theory, Social Constructivist Theory and the Theory of Cognitive Development, all informed future educational practice in museums. These theories place guided interaction with the environment targeted at student's level of learning readiness as fundamental to learning. Vygotsky's theories highlight several key aspects for effective learning: zone of proximal development (ZPD), more knowledgeable peers, scaffolding and authentic activities. The zone of proximal development is defined as a point in learning where students can draw on previously learned knowledge and skills while being able to process new ideas. ZPD represents learning readiness in which any topics or skills taught at this point would generate more optimal learning. Guidance by a more knowledgeable peer is crucial in fostering new learning. This peer can be a parent, a teacher, a friend who knows more, a technology, a new environment, etc. New information from the peer is delivered through the demonstration of ideas, positive values, techniques, strategies in which the learner could internalize. Scaffolding is about creating customized guidance which is gradually withdrawn and is provided by a more able peer and introduced at the point of learning readiness (ZPD). However, assistance or guidance provided by teachers would be meaningless if the teachers fail to identify individual ZPD of the students. Each student learns very differently though, having different prior knowledge, responding to different teaching styles and paces. Scaffolding can mitigate these differences by identifying individual ZPD and customising it to the individual learner. Museums integrate these ideas through exhibits that are designed so that visitors can generate meaning by interacting with the exhibit (Hein, 1995). Hein added that such arrangements would promote the visitors to think critically as well as make connections between what is exhibited and their prior knowledge.

Hein is also a strong advocate of John Dewey, another important figure in the establishment of constructivism. Dewey was a strong believer in the power of experience to enhance education. He believed that we had to understand the individual's experience to determine enough learning outcomes saying;

“If we see that knowing is not the act of an out- side spectator but of a participator inside the natural and social scene, then the true object of knowledge resides in the consequences of directed action.” (Dewey, 1960, p. 196)

Hein though sees this as only the beginning of a successful learning experience. He asks “How can the educative value of experience be enhanced” and believes “connected, engaging, integrated activities...lead to growth” (Hein 1998, p.155)

Hein would go on to design a model of evaluation which draw upon much of the aforementioned pedagogies. It focuses heavily on the idea on interactivity and learning outcomes, while also drawing on educational theories related to the work of John Dewey as explored above. Next we will explore it in more detail.

Hein’s Museum Education Theory Model

George Hein developed an educational model for museums known as “The Museum Education Theories Model” (Hein,1998). This was strongly influenced by constructivism and behaviourism and the theories we have expanded upon previously in the literature review. Built on Dewey’s philosophy of education, Hein (1998; 2004) viewed learning as an active process that requires the learners to activate both their mental and physical attributes. Education-based programs should be organised to foster critical thinking yet leading to one right answer or one correct interpretation. Activities organised should enable the learners to be a part of active participation. (Hein, 1998). By combining a study of constructivist learning with the more modern discipline of visitor studies, he concludes that visitors learn most effectively when museums design exhibitions that are physically, socially and intellectually accessible. This in turn leads to him advocating for the establishment of a “Constructivist Museum”. Hein is convinced by the validity of constructivism in the museum environment saying that:

“Constructivist pedagogy is appropriate for museum education because it capitalizes on the way in which museums interact with visitors. It is also politically important; it advocates a style of education that is necessary for supporting critical thinking and for developing a society that values diversity and respect for others.” (Hein,2001, p.5)

The most relevant question to this study though is how these theories connect with the use of Interactive Digital Media in the museum. Although they continue to inform much of Museum Studies, they must also be adapted to a new modern context.

Interactive Digital Media in Museums

Interactive Media covers a wide range of different media within the museum and the general consensus that emerges from the literature on its use within the Museum is that not enough research has been done to validate its benefits or detrimental value as of yet. (Kidd, 2014, p. 102) Defining interactive media is in itself a difficult proposition and in a review of the literature seeking to define interactivity, Quiring and Schweiger found that all definitions are “missing distinctiveness, conceptual clarity, and attempts to systematize the various theoretical and empirical findings”. In their analysis they put forward a framework for gradual evaluation of interactivity. “We therefore consider processes interactive that admit bilateral exchange of meaning and cover at least one interaction sequence comprised of two elements (inquiry-answer)”. (Quiring and Schweiger, 2008, p.162) Therefore I will use this as the lowest threshold for defining interactivity. At some stage a user should interact with a resource that will return information in some way and not be a passive observer.

Importantly though this does not mean physically touching a resource. As Adams et al (Adams et al, 2003) point out, a video camera tracking your movements to allow you to edit a picture on a screen far away, is still interactive without any touching.

3d-Environments and interactive surfaces are some of the most common forms of Interactive Media within Museums but they can also be divided amongst their different hardware. 3-D environments of museums are a popular tool amongst museums but often they might never involve the user setting foot in a museum. Therefore, for the purposes of this study, on educational resources in a museum, I will further distil the definition of Interactive Digital Media as Digital Media which involves user interaction, with the precise goal of increasing learning outcomes as opposed to entertainment value or generally increasing a museums profile or outreach.

Digital Media has proliferated through all our lives so it's presence within a museum is rarely discussed within the literature. Instead much of the study on Interactive Media focuses on

its effectiveness and how best to implement it. There are some examples of studies that have been carried out.

In a 2013 study on four interactive resources in art museums, Pierroux and Ludvigsen found that “on preliminary analysis of interaction data in the museum, young people’s engagement with these resources appears to advance meaning making in a conceptual direction”(Pierroux et al,2013 p 173). This would suggest therefore that interactive resources can have a tangible benefit.

James Katz and Daniel Halpern studied realistic 3-D models of museums and found that “as a result of this realistic environment, learners can become more motivated and engaged with the material, thereby cognitively processing the presented material more deeply”. Interestingly their approach incorporated many constructionist learning theories. Yet even they add several caveats to their findings. For example, they acknowledge that the content of any exhibition regardless of the method used to communicate it could be more important than the media. So a 3-D exhibit might register very positively among visitors but it is important to try and isolate whether the content or medium was responsible for this. They propose using the same content in 2d and 3d models to analyse the differences. They also acknowledge that the students used in their studies were “forced” to take part but that leaves unanswered questions over whether 3-d resources would be more likely to draw visitors in and hold their attention if they had a choice over whether to use them. (Katz, Halpern,2015)

One consensus that has been reached though is that Interactive Media is reliant on many external factors to be effective, specifically the expertise of educators and an understanding of its value. Jenny Kidd uses several case studies to show that “It is important that visitors, beyond making sense of an interactive as a stand-alone interpretive tool, are able to understand that encounter within the overall framework of the museum and their museum visit” (Kidd, 2014 p 102). Again, and again the literature points to Interactive Media’s effectiveness being dependent on its application and crucially this is in turn dependent on the skills and knowledge of the practitioners of Interactive Media (Sebastian Hall 2013)

This same idea is mentioned in a comprehensive report on Education within British Museums prepared by the Arts Council in England in 2016.

“... At a time when [our] role is more important than ever, too many museum educators lack the training, resources, or support to address the technological opportunities and challenges they face. Lack of adequate preparation in the use of common digital technology in university training for museum educators coupled with few choices for ongoing professional development is creating a vacuum of skills just when they are needed” (Arts Council England,2016 p)

The same report finds that;

“digital technology is both a barrier to and enabler of formal learning in museums. Many museums struggle to maintain an effective web presence and keep up with the fast-changing Executive summary continued 9. Only 45 per cent of survey respondents have internet access in gallery spaces; 51 per cent have internet access in education spaces and basic infrastructure is particularly uneven in rural locations. Thirty-one per cent of survey respondents did not consider it desirable to have an online booking system. Our survey and focus group discussions found that teachers and museum educators are sometimes conflicted about the place of digital technology in museums, because they value the encounter with real objects and the mediation of museum experts. But they nevertheless recognise that children and young people now expect to access digital technology in every aspect of their lives.” (Arts Council,2016 p27)

Adams et al found that despite the popularity of interactives in art museums, new issues were associated with their incorporation as well, “institutional commitment, design process, and visitor expectations”.

Conclusion

A review of relevant literature reveals some clear consensus around the most effective models of learning within museums but some unclear results around the potential of Interactive Media to add to better learning outcomes.

In relation the pedagogy, we can see that many of the theories put forward by academics align with the criteria that the Arts Council of England put’s forward in its “Quality Principles

for working with children and young people” which is intended to provide a general framework for evaluation in museums. It lists the following “

- Striving for excellence and innovation
- Being authentic
- Being exciting, inspiring and engaging
- Ensuring a positive and inclusive experience
- Actively involving children and young people
- Enabling personal progression
- Developing belonging and ownership”

(Arts Council, 2016 p.32)

We can see many of the ideas that come up again, albeit in a more general form. Active learning, inclusive learning, meaning making, authenticity are all themes we have come across in our analysis of pedagogies in museums. It’s interesting too that all these points take the for granted the role of museum staff. The idea of peer guidance, so crucial to social learning theories, is embedded in their recommendations.

To analyse the use of Interactive Media effectively, it is crucial that we look at it’s application in the broader context of the environment it is being used and crucially the pedagogy at play in those theories. Based on the research so far, I will propose a framework that is intended to help create an “ideal” museum. By using a defined framework, it will better help me to collate the various pedagogies mentioned throughout the literature review.

Chapter 3: Methodology

Methodology

I have chosen to use case studies to analyse the impact of interactive digital media as learning tools in museums.

The literature review has clearly shown how important it is for museums to have a considered and clear pedagogy underlying their educational content. A strong pedagogy that can produce good learning outcomes is a pre-condition for the use of any resource, including interactive digital media, as it informs the effective application of that resource. A case study will therefore allow me to analyse if the underlying pedagogy is in place and how interactive media fits in to that.

Throughout the literature review sections on learning in museums we have seen strong theoretical arguments made often without much regard to the conditions that museums operate under. As pointed out in an analysis of the literature on IDM, there are many practical considerations that can either challenge the application of theories or render them completely redundant and it would be negligent not to consider these. Budgets, staff, physical locations, mandates and visitor numbers or expectations all influence the decisions a museum can make. This is illustrated particularly well in the Irish Museums Survey of 2016(IMA,2016). It clearly lays out many of the practical issues faced by Irish Museums. For example, many museums lack any educational department or dedicated educational practitioner. While fully acknowledging those issues, for the purposes of evaluating Interactive Digital Media I will choose a museum that uses an abundance of Interactive Digital Media in its school programmes and educational content aimed at young learners.

Evaluation criteria

I propose to use the criteria set down by George Hein in his book, Learning in the Museum (Hein,1998). His vision of a “constructivist” museum embodies many of the theories mentioned in the literature review. It also has two relevant overlapping focuses with studies on Interactive Media. Firstly, the use of “Interactives” although not specifically related to digital media allows room for the integration of Interactive Media in to his construction of an ideal museum.

Secondly, he places much value on the learning outcomes produced by museums. As we have seen previously, evaluation has been a major issue in analysis of Interactive Digital Media. By using the framework, he has suggested, along with the data available, we can hopefully see how effective Interactive Media has been in these respective museums by seeing its place within its education programmes and evaluating its impact on learning outcomes.

In his advocacy of a constructivist museums Hein begins by posing three questions that he views as essential to the creation of such an environment.

“What is done to acknowledge that knowledge is constructed in the mind of a learner?”

“How is learning itself made active? What is done to engage the visitor?”

“How is the situation designed to make it accessible to the learner?”

(Hein,1988 p.152)

In answering these challenges, he puts forward the components he feels are necessary to create a constructivist environment and thus the most optimal learning environment in a museum. Firstly, the museum must foster a “connection to the familiar”. This can be in the sense of previous learned knowledge, making the actual structure seem welcoming and grounding the environment in surroundings familiar to a learner. This means making the space comfortable and welcoming and creating connections from objects to the learner. Secondly a museum must ask itself if it is catering to all types of learning styles available. This means incorporating verbal styles, logically maths-based styles, theatre, drama, audio and creative resources like art classes or song creation. This also applies to the idea of maximum accessibility for all types of users. Next collaborations, between museums, educational institutions and other community bodies is necessary to foster different interpretations of exhibitions. A museum must also be very aware of prioritising social interaction. This means fostering learning through group activities and creating resources that encourage cooperation. Hein also believes museums must make sure that they are catering to all developmental levels, through various backgrounds of education, age and social status, creating resources that are appropriate for all those groups. Finally, to create a truly constructivist museum Hein feels it is essential that Museums constantly study

visitors, acknowledge their input and adapt to the meanings they create in the museum. Hein would later expand on his work and acknowledges five challenges faced when implementing a constructivist museum.

Firstly, it can be difficult to acknowledge other learners own personal meanings and so museums should focus more on processes instead of content. As an example, he cites the Boston Museum of Science for its focus on “science processes, such as observation, experimentation, classification, etc”. This approach is in direct opposition to the traditional mission of many museums. Secondly, the idea of changing someone’s “concepts” can be a lot more challenging than it seems. People are not always easily convinced and can be dogmatic in their beliefs. Next, ideas of personal meaning might run in direct countenance to established ideas or thinking on a subject. Finally, museums need to rethink how they measure success. For Hein, this means evaluating the success of a museum based on “evidence of skill development” and “examining how visitors interpreted the experience.”

It will therefore be these criteria upon which I will be evaluating the use of Interactive Digital Media in the education programmes of both museums. Below I have developed a checklist upon which I will base my evaluation of both museums. The checklist will allow me to evaluate if a museum is creating a conducive learning environment and the role of, if any, of Interactive Digital Media sources in this construction. I have added one extra point not mentioned by Hein, which is staffing expertise, as this was one attribute of effective interactive media that continually emerged in the literature around Interactive Media.

Connections to the familiar.

Using a learner’s prior knowledge is integral to learning and a key constructivist principle. This means making an association with knowledge that the learner brings into the museum. Therefore, the question is what effort is made to allow visitors to connect between their known knowledge and new material?

Associations with place.

How does the museums architecture and lay out enhance learning? Do visitors have freedom to move, comfort and competence. In relation to comfort I will look at if the museums stimulate the learner's senses without making them feel confused or over stimulated?

About competency, can the learner incorporate new inputs and information without feeling overwhelmed?

Learners Modality

Does the museum attempt to incorporate as many learning styles as possible? For people who learn visually, by reading or by touching and debating an idea. Visitors who are more logically minded, perhaps puzzles that would stimulate their learning. This would also incorporate learners who might be visually impaired, hearing impaired or have specific learning needs.

Collaborations

Does the Museum work in conjunction with other organisations, libraries, schools, community groups to maximise the effect of their exhibition?

Social Interaction

People generally visit museums in groups so does the museum provide resources for cooperative learning? Does it draw upon shared experiences? In what way is the museum designed for these social interactions? Social interaction is a key concept of constructivism and is a very important consideration in how effective learning is within the museum.

Developmentally appropriate

How does the museum consider various levels of intellectual development? How does it strike a balance between different ages? Or cater to different levels of education. Does it create separate areas, or does it focus on maximising the most accessible aspects, doing away with labels or potentially difficult technology and rely on images and audio.

Intellectual challenge

Hein sums this challenge up quite neatly in a question he believes all museum practitioners should consider when designing an exhibit: “Will this challenge our visitors but provide them with enough familiar context, so they can rise to the challenge?”

Publicise the process

Hein believes a key role of the museum is also to make sure that the museum makes its choices as transparent as possible. The reasoning behind this is that essentially all exhibitions are a matter of choice. It is therefore imperative that museum workers make it very clear what decisions and considerations they have taken on board in designing their exhibits.

Collate and integrate feedback

How does the museum acknowledge feedback and crucially integrate it into its work? How does it collect that feedback, decide on its relevance and importance and incorporate it into its current or future design?

Staff

In the literature review for Interactive Media, knowledgeable staff were a pre-requisite for beneficial learning outcomes. It’s important therefore to assess the competency of the staff as it will have a direct correlation on how social interaction.

Learning outcomes

As previously mentioned these will be evaluated based on “evidence of skill development” and “examining how visitors interpreted the experience.” These will in effect determine the success of the learning programmes. It should follow that if the previous steps are adhered to, the outcomes the answer to both questions will be positive.

Chapter 4: Case studies

I will study the examples of The British Museum in London, England and The National Irish Museums Decorative Arts and History in Dublin, Ireland, abbreviated as MDAH. They offer up some very interesting comparisons and contrasts in terms of their use of Interactive Digital Media.

In terms of similarities, the most obvious is that both are history museums and come under the remit of their respective governments. Their source material is therefore quite similar, both have a strong emphasis on historical objects as the most prominent medium within their exhibitions. Both Museums cater to similar demographics that this study will focus on, groups of school children aged 8 to 16. Therefore, they share a similar educational mandate, to provide excellent educational resources based on their collections. Neither are exclusively focused on their domestic histories though, with the British Museum encompassing many eras and cultures and the MDAH sharing its space with Decorative Arts.

Their differences go to the heart of many of the issues raised in the previous literature review of Interactive Media. They operate with two wildly different sets of resources. In terms of staff, finances and available resources, the British Museum far exceeds the MDAH. As the larger institution catering to more visitors this should be no surprise. One point regularly emerging from the literature review though was how important staff knowledge and resources were in creating the best possible experiences. Secondly although they cater to similar demographics, the British Museum deals with far more foreign visitors than the MDA, proportionally and quantitatively. This is especially important given our previous reflections on the importance of knowing your visitors for good design.

I have also chosen the British Museums as it has a stellar reputation when it comes to Digital Media, including Interactive Digital Media. The Samsung Digital Discovery Centre (SDDC), from under-fives to teens, won the 2017 Leading Cultural Destinations Award for Best Digital Museum Experience. They have been innovative in their education outreach, creating “Virtual visits” for schools across the U.K and offer exemplary training opportunities for staff.

The MDAH offers a valuable comparison, as it is on par with most national museums in terms of resources. The MDAH also has a unique element to its mandate as it is prominently involved in the commemoration of historic events such as Ireland's "revolutionary period".

In combination these two museums offer two similar mandates on two completely different scales. It will be interesting to see the effect of the different scales on the resources, approaches and ultimately the learning outcomes of both museums.

The amount of information available to me should allow for two comprehensive case studies. The British Museum publishes wide ranging reports and case studies on its work, the most recent going all the way up until March 2018. Although the MDAH is less robust in its reporting, I will be able to have first-hand access to the museum.

The British Museum

The British Museum's digital programme takes place in a dedicated space known as the Samsung Digital Discovery Centre (SDDC). Drawing on analysis and research undertaken by other academics I will evaluate the centre and IDM resources based on the above criteria. The centre's educational output related to young learners is twofold. It runs family sessions and school sessions. The case study will reflect on both but will primarily focus on the educational programmes for schools which would reflect the pedagogical choices of the museum better. The IDM resources that will be analysed will be the Hajj mobile app and related workshop, which teach primary school students about the Hajj (Von Aesch, 2012), Multimedia Magic educational experience which teaches primary school students about Buddhist artefacts using tablets as guides around the museum (Doll, 2012) and the Cultures in Contact project which taught secondary school students about different cultures around the world using a variety of Interactive Digital Media (Biggs, 2011).

Connections to the familiar

In her 2011 dissertation Katherine Biggs looked at the "Cultures in Contact project" run by the British Museum. Her focus on enquiry-based learning prioritised prior learning as a key

aspect of meaningful learning. She found that the main source of prior knowledge that the students drew upon was derived from pre-sessions carried out by museums practitioners in schools prior to the student's trip to the museum for example the museum activity opened with an introduction and a reminder about the importance of the symbols they had learnt about in school (Biggs, 2011). However, this only applied to one section of the student's project on the day. In two other areas she found that "The children did not outwardly use any other background knowledge and seemed to have little knowledge of the countries and the objects that they were analysing." (Biggs, 2011:34). At the same time, she found that lack of prior knowledge didn't impede the students from understanding the key points of the course either. She found that the pre-session which established prior knowledge seemed to have a positive effect on the learning outcome but did qualify that by saying further study would be required. Regardless, the use of pre-sessions shows the acknowledgement of the importance of prior knowledge by the British Museum.

Alessandra Von Aech also looked at the importance of prior knowledge in her study of the "Haji Mobile workshop". Her results were very similar to Biggs. Von Aech found through pre-surveys that the students had very little prior knowledge saying, "the students have not seen themselves as well prepared" (Von Aech,2012:81) before coming to the museums workshop, despite each teacher using the British Museums pre-session worksheets and materials. Yet the lack of prior knowledge didn't seem to have any adverse effect on the eventual learning outcomes for the students. In theory though, better preparation could have meant improved learning outcome.

In their study of the Samsung Digital Center, Sabiescu and Charatzopoulou point out how the museums seeks to link up with the British school curriculum as much as possible and constantly review documents published by the UK Department for Education, and the Department for Culture, Media and Sport, and the National Endowment for Science, Technology and the Arts (NESTA) (Sabiecu et al. 2015). In this way the museum is making sure that it is aligned with knowledge that the students have already formed.

At the current moment the British Museums website also provides comprehensive preparatory material for any school who is visiting the museum for one of their workshops. (British Museum, 2019)

Overall it can be confidently said that the British Museum works hard to connect its programmes to learner's prior knowledge and in many cases establish it when necessary.

Associations with place.

The SDDC space where much of the interactive media is housed is essentially a studio that houses the technology. In assessing the comfort and competency of the space it is important to consider that it works in symbiosis with the museum and all the technology is designed to be used with the museum's collections. The facilities exist for young learners to take a digital resource like a tablet and engage with a museum with as much freedom as they would like. However, when the museum is designing programmes they are very conscious of how overwhelming the space can be, given its sheer size. To mitigate this, the museum structures their education programmes around a limited number of items and themes. For example, the designers of "The Cultures in Contact" project, chose five objects for each of the six countries studied ". She points out the benefits of this as feedback from one student reads ""It was a really nice way of focussing us. If I'd come with family we would have been rushing around seeing lots of galleries and not learning anything" (Biggs,23).

George Hein himself has stated that repeated visits to museums to help children become familiar with the environment (Hein, 1991). In this regard the cultures in contact project is an excellent example of fostering familiarity as the project was run over three years so students attending the workshop in 2011 had attended the previous two connected sessions as well. (Biggs, 2011).

Learners Modality

SDCC sessions are very aware of creating sessions that reflect a broad range of different types of learners. Sabiescu et al. note that visual, kinaesthetic, and social learning in particular are very well integrated to the offerings saying ".sessions support different learning styles often not privileged in schools such as visual, social and kinaesthetic learning."(Sabiescu et al 2015 p 31) In the same paper "Catering for different learning styles" is one of the six "common considerations and design principles" that aligns the SDCC with the museums broader vision(Sabiescu et al 2015:12). They mention the use of AR as a

particularly effective example of visual learning for young learners. The school programmes are also regularly reviewed to ensure that they are catering to all different types of learner as the Learning Programmes Manager puts it “For our school sessions we have done another process of review just to make sure that different ways of learning particularly social learning are integrated” (Sabiescu et al p.17). In developing the Haji mobile app, the designers recognised the importance of integrating different learning style (Von Aesch, 2012:45) and these were integrated into the finished product. She also found that the students feedback showed that they all found different aspects of the app as their favourite and “various learning styles is just one reason for this distribution” (von Aesch 2012:82). So we can see that many different types of learners are finding aspects of the app that they can relate to and are attracted to.

Collaboration

The SDCC is very strongly focused on collaborative efforts. The most obvious collaboration is with Samsung which has allowed the centre to use cutting edge technology such as smart watches and Virtual Reality headsets. The centre also work closely with schools and governing bodies to match up the programmes offered with the current curricular goals and consult advisory panels including teachers when designing resources. (Sabiescu et al, 2015). One example is the “Symbols and statues in Buddhist belief” which linked up with “curricular areas of Religious Education and Computing for KS2 students.” and “building skills in digital video, digital photography and multimedia presentation design.”(Sabiescu et al,2015:11). The museum also collaborates with young students in more informal ways such as TakeOver day where students helped teach a school’s session and learned about communication and conservation. (Sabiescu et al 2015)

Social interaction

On this point, Social interaction is a key tenet of the SDCC. In this regard it represents the strongest overlap between the SDCCs pedagogy and constructivist principles. Sabiescu et al. found that “Social learning is supported in most learning activities.” (17). Susanna Dolls analysis of the Multimedia Magic schools project found that social interaction was prevalent throughout the project. The students themselves saw the experience “as a social experience and the interactions with their classmates played a major role for all of them.”

(Dolls,2011:88) Dolls found that the social interactions improved the learning outcome for students in several ways, helping them learn more through co-operation, remember more and extend the experience beyond the museums as students recalled having conversations about their experience after leaving the museum. (Dolls,2011: 78)

Developmentally appropriate

The SDDC is very explicit that the “content, activities and the type of engagement are defined and modelled according to the developmental stage and the audiences addressed”. (Sabiescu et al,2015:13). These can generally be grouped in to school, family and teen sessions. Within those the type of activities engagement activities is adapted to specific ages for example “, hands-on manipulation and kinaesthetic learning are favoured approaches for Early Years students” whereas teen learners’ sessions are “highly experiential and give attention to process as much as they do to content”. (Sabiescu et al,2015:14).

Intellectual challenge

According to Hein, the key here is to provide content that is challenging while using familiar knowledge. (Hein 2001) The British Museum does this very well by looking at what the students are learning in school but then drawing on their own resources to provide a different type of learning for the students.

The content of the Haji mobile app is designed to be “challenging but not overwhelming” (Von Aech,2011 p.86)

Publicise the process

The British Museum is quite clear in its publication of the choices it makes and how they reflect the programmes it produces. The programs and session offered are informed by the overlap between the objects in its exhibitions and the national curriculum for schools in England. The design principles and the learning methodologies are also available to the public through its website. These include interviews with employees of the centre, case studies and research on the methodology behind the design of projects for young learners. (Insert link to website). Therefore, it is fair to say that the British Museum publicises its decisions very prominently.

Collate and integrate feedback

Sabiescu et al. lay out very clearly the criteria used by the British Museum about feedback for its exhibitions. Firstly, sessions are “iterated a few times, and feedback is integrated from participants until reaching a formula that reaches expectations”. They acknowledge that feedback is very often only integrated at the end of a school year though in contrast to family sessions which are updated every two months (Sabiescu et al, 2015:18). SDDC education managers collect feedback through forms filled out by teachers and observation. Sabiescu et al note though that the museum is currently in the process of reviewing its feedback process. That paper would have been published four years ago and no information was available on how the centre currently collects feedback. It is clear however that the centre is very focused on receiving and integrating feedback.

Learning outcomes

Not only are students at SDCC honing their own skills but very often they are learning new skill, as Sabiescu et al note “The type of content knowledge and skill areas covered, which are defined and redefined in a responsive way following societal trends, whilst often school curricula are lagging behind.” (Sabiescu et al, p.31.). Sabiescu and Charatzopolous study focused on key competencies developed in relation to lifelong learning, and they show how the SDCC fosters the development of several skills such as “digital literacy, communication, cultural awareness and expression, and social and collaborative skills” (Sabiescu et al, p.31) Susanna Doll found that students learnt many things from their participation in the Multimedia Magic workshop. These included behavioural outcome likes sharing (Doll, p.98) and more traditional learning outcomes like facts about the gallery’s artefacts (Doll, p.92). Doll also found that the ICT skills of the students were improved, even as they struggled with technical difficulties with the equipment (Doll, p 102) Von Aech also established two relevant learning outcomes, students retained information about the topic and they improved their ICT skills by using the mobile phone in a way they had never used mobile phones before (Von Aech,2011,p.86) Furthermore she finds a direct correlation between Interactive Digital Media and positive learning outcomes saying “During the workshop the students learnt about the process and importance of Hajj by using a mobile app individually

and in groups".(Von Aech,2011,p.92) although she does qualify this by stating that a longer study would produce clearer results.

Staff

Evaluating the staff was an elusive and fruitless search. The museums don't provide any information on its staff or it's evaluations of the staff. It is even difficult to determine whose role is what. Naturally given the concerns over privacy this makes sense, but it meant I didn't have an opportunity to see what training staff had, what projects they worked on or any information that evaluated their role. What I can say is that by extension, if the programmes are being effective we can say that someone had to design and thus deliver those programmes, so they have succeeded in that way. Although we can't assess them in any formal way the staff are well trained and knowledgeable when it comes to digital media.

The National Museum of Ireland: Decorative Arts and History

Like the British Museums, Collins Barracks work with young learners take place in two ways, through school visits and self-guided visits for families. In assessing Collins Barracks there was less published research available for assessment than that for the British Museum and so instead I relied on the available material published on their website and my own site visit to the museum. The Education Department offers a combination of tours and workshops to schools and online and on-site resources for self-guided groups as well. In contrast to the British Museum however Collins Barracks works closely with many other Irish museums to draw on their available resources to compliment its own object orientated programmes so there were times where the museum draws upon the resources of other museums.

Connections to the familiar

The Education department provide a significant amount of material intended to prepare students for their visit to the museum, including recommended reading and links to many websites where much extra information could be found. They also connected and illustrated the connections to the parts of the curriculum which overlapped with the programmes on offer. "Guided Tour: Recovered Voices: Stories and Experiences of the Irish during World War One" is the only interactive tour available. In terms of interactive digital media, the closest resources available multimedia resources of short videos in which historians talk through individual years but on the micro site you can access specific preparatory notes for school visits. Many of the external resources contain multimedia and interactive activities. Unfortunately, many of the preparatory activities lead to broken links. For those that are still available they contain information on potential topics for discussion, activities, specific areas of overlap on the curriculum, themes, learning outcomes and further links to websites of related museums and organisations. Although Interactive Digital Media is therefore not present in any of the preparatory work, the museums do provide comprehensive resources for teachers aimed at establishing prior knowledge before schools and young learners visit the museum.

Associations with place

The layout of Collins Barracks and the museum in general is quite large, so it can be confusing for many visitors. The exhibitions though are well thought out. The first step taken by the museum is to break the exhibit down into a select few objects for each programme offered. For example, in their exhibition on 1916 they whittled the exhibition down to ten key objects and used them as access points to wider themes. The exhibition "Recovered voices." is a good example of using the ample amount of space provided to provide space for learners to congregate around an object and see it from many perspectives. (Picture). So, in these ways the museum creates a more comfortable atmosphere for learners and manages to overcome potentially overwhelming large space and daunting collection.

One area that could have been improved upon was making the museum more familiar to learners. The British Museums programmes operated over three years so by the final year the students were comfortable in their surroundings. I saw little evidence that the museum was forging especially long-term relationships.

Unfortunately, IDM was absent again while evaluating this criterion.

Learners modality

The museum fails to offer much of a variety to cater to different learning needs. The resources for all age groups focus on the use of activity books but the workshops themselves do slightly alter their learning approach. The primary workshops work as an inquiry-based programme whereas the post primary work on as primarily object-based enquiries. Neither makes use of interactive media in a way that would specifically enhance the type of learning that they are focused on though. So, although the content and structure changes, both use activity books and worksheets as the main supplementary resources.

There are more attempts to provide for different learners in a broader sense in terms of facilities. The museum has an arts and crafts area and an area where learners can try on different outfits and handle some artefacts.

Again, Interactive Digital Media is absent from any of the available resources.

Collaboration

The museum does make a concerted effort to collaborate with other organisations, but interactive digital media and indeed digital media of any type is conspicuous by its absence. There is a strong connection between the museum and local schools as illustrated in the “Local Heroes” project and “Commemorating 1916 in Dublin”.

They connect with other institutions and in the case of the National Library, they draw upon many of their available multimedia resources. Inspiring Ireland is another partnership that broadly falls under the remit of the Education department which provides access to digitised versions of artefacts in the museum.

The lack of any collaboration either involving digital media or with any organisations involved in digital media stands out. All the collaborative efforts seem to pool knowledge but don't focus on building skills or trying to integrate IDM in any way.

Social interaction

The resources available to teachers intended as guides for students do contain a strong element of social interaction. These often take the form of talking points and ideas for debate amongst the groups of students. Guided tours do emphasise social interaction as well, by encouraging the students to voice their opinions and encouraging the students to discuss elements of the exhibitions amongst themselves.

One finding during my study of the British Museum however was that IDM could enhance social interaction in many ways. Therefore, it seems to be a missed opportunity to not ask the students to even use their own digital resources like mobile phones, and integrate photo taking or video creation in any way. These are easy ways to enhance social interaction without the need for a huge amount of investment.

Developmentally appropriate

Collins Barracks group their programmes in very general terms. They are divided in to primary and post-primary. In these scenarios the structures of the offered tours and

workshops are broadly appropriate to the age groups, but they mostly take their guidance from the curriculum as opposed to underlying pedagogical theories. For example, there is no acknowledgment that younger learners might benefit from more kinaesthetic activities. Opportunities for Kinaesthetic learning do exist, in the Recovering Voices exhibition, young learners get to handle a replica gas mask and uniform jacket, but these experiences are not integrated into any activity.

Publicise the process

Many of the choices for exhibitions and workshops seem to be related to commemorative events, such as World War One and the 1916 rising but others such as the collection of furniture don't have any connection to contemporary commemorations. One exception is the curator's choice exhibition where the curator is explicit in her choice of items on view. Regardless these are more inferences than information gleaned for any explicit explanation of the process.

Collate and integrate feedback

Feedback is exclusively collected through surveys which are handed out to participants after taking part in workshops and visitors to the museum also can provide feedback on site towards the end of their visit with survey forms. Interestingly none of the forms ask the visitors to reflect on the use of Interactive Digital Media or comment on the methods used to teach young learners.

Findings

The case studies show that a lot of the research shown through the literature is borne out in practice. A strong theoretical framework allows IDM to work effectively and produce beneficial learning outcomes. By drawing on examples of different source of Interactive Digital Media I was able to point out where the British Museum was aligning itself with the framework and thus a constructivist pedagogy. However, it wouldn't be accurate to say that as their programmes all adhere strictly to constructivist principles. The influence of

constructivism is very strongly present though and positively effects the learning experiences. We have seen active learning and social learning taking place. In nearly all the criteria laid out, examples of the applied Interactive Digital Media adhering to those criteria were found.

In the case of the NMHAD the issues raised in the literature review and IMA's own Museum review were prescient. There seems to be a complete lack of institutional support and not even a token effort at integrating Interactive Digital Media. Although it was disappointing to discover this, it was nonetheless illuminating to see how far NMHAD has to go to be on par with other museums.

The differences between the two museums are both stark yet both seem to be at different stages of the same path. Both museums adopt very similar pedagogies, have similarly proactive relationships with local communities and are successful in attracting visitors and providing worthwhile learning experiences. The biggest differences come in their resources. In terms of resources there is almost no comparison. SDCC is an exemplary example of the use of interactive media that few museums in the world could match but even by comparison to its peers within Dublin, the MDAH lags woefully behind. It's failure to develop any app or mobile enhance learning facility, which could be developed at a low cost. It should be noted that some of the Interactive Media analysed was also almost seven years old now but still more advanced than any resource the MDAH has made.

There are some encouraging results though, the SDCC shows that Interactive Media can be used effectively to create excellent learning outcomes, and this comes about from a combination of strong pedagogical focus and a creative application of technology. Collins Barracks has the same strong pedagogical foundation, it just relies on more traditional sources.

The 2016 Museum survey perhaps hint at the underlying issue at play. Integrating Interactive Digital Media is not considered a priority, given the plethora of concerns facing so many museums. However, many other museums, including state museums have made efforts to integrate Interactive Digital Media in to their work and to this extent the lack of almost any resources is puzzling.

Chapter 5: Conclusion

In this study I set out to analyse the use of Interactive Digital Media as an educational tool in museums. I reviewed the existing literature around education in museums, learning theories in museums and interactive digital media in museums. I found that that research was established around effective learning theories in museums but was generally inconclusive when assessing the impact of interactive media in improving learning outcomes. I therefore hoped to evaluate how well Interactive Media improved educational outcomes in museums by evaluating looking at in the context of educational frameworks shown to.

I chose to analyse the use of Interactive Digital Media using a constructivist framework. It was an established pedagogy at use in museums and it placed significant emphasis on interactivity. I undertook a case study of two museums, the British Museum and Irelands National History Museum.

Firstly, this study showed that IDM is an ideal resource for teaching students aged 8 to 15. It fits in very well with the established pedagogies of museums and helps work towards fulfilling learning outcomes. It also created new learning outcomes, specifically ICT skills and had many tertiary benefits such as improving enjoyment and engagement.

The case studies allow us to isolate some key elements necessary for the success of IDM in museums. IDM must be applied with very clear pedagogical goals in mind. Institutional support is vital for IDM to thrive and although not every museum can have the luxury of a technological sponsor, as an organisation a museum can prioritise Interactive Digital Media and look at low cost solutions.

This study has also shown that some issues persist. Measuring the impact of IDM seems frustratingly intangible. Further study could involve running two identical programmes with and without IDM to see the difference in learning outcomes. However, it seems the value of IDM will always be evaluated for it's learning value in tandem with it's potential to attract and engage visitors as well. Financial concerns play a large role in its application as well and it's use as a vehicle for brand promotion and the influence these considerations have.

The case studies show clearly that both museums are already implementing many of the principles advocated by George Hein and thus many constructivist ideas. These ideas are

clearly separate to the use of Interactive Media, as in the case of Collins Barracks where the lack of Interactive Media doesn't impede the implementation of those ideas.

In terms of learning outcomes, more study would be required to determine if students of attending the British Museum had better qualitative learning experiences than those at the MHAD due to their use of IDM. The most distinctive disadvantage for Irish students was that the absence of IDM means they failed to gain any ICT skills in comparison to students at the British Museum.

This study has shown that Interactive Digital Media can undoubtedly produce excellent learning outcomes. In the case of Collins Barracks, it shows that the structure and pedagogy is in place for Interactive Media to be used with the potential to improve learning outcomes. Thus, in the context of a constructivist pedagogy Interactive Media has the potential to create engaging content and improve learning outcomes.

Further research

Further insight in to the reasoning behind the lack of Interactive Digital Media in other museums including Irelands National Museum would have been very interesting. We know from the literature review that museums often face practical considerations like lack of institutional support and it would be interesting to hear from representatives of the museum as to exactly why Interactive Digital Media is so lacking in Irish Museums, especially considering its prevalence amongst many other museums, both within Dublin and on a broader international scale.

It would be interesting to apply other frameworks based on other educational models to the use of IDM to see what results would have emerged. For example, Falk and Dierkings contextual model of learning (Falk et al,2013). This would allow museum practitioners and academics to distil further the exact elements of certain pedagogies where IDM thrives.

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