Shaping a Culture of Lifelong Learning for Young Audiences: 
A Case Study on The Samsung Digital Discovery Centre at the 
British Museum

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Table of Contents

1. Introduction .............................................................................................................................................. 3

2. Study methods and concepts .................................................................................................................... 4
   Research questions ................................................................................................................................. 4
   Concepts and approach ............................................................................................................................ 4
   Methods .................................................................................................................................................... 6

3. A venue for learning through discovery .................................................................................................. 7
   The Samsung Centre in the museum ecosystem ....................................................................................... 7
   Digital learning through discovery .......................................................................................................... 8
   Spaces and technologies .......................................................................................................................... 8
   The educational offer ................................................................................................................................ 8

4. Learning content and design approach .................................................................................................... 10
   Knowledge and skill areas ....................................................................................................................... 10
   Design principles and strategies ............................................................................................................. 12

5. Modelling digital interaction for object-based learning ........................................................................... 19
   Digital interaction patterns ...................................................................................................................... 19
   Dealing with technical challenges and the unexpected .......................................................................... 25

6. Shaping a culture of lifelong learning for young audiences ..................................................................... 27
   Shaping key competences for lifelong learning ....................................................................................... 27
   Engaging the lifelong learner ................................................................................................................. 29
   Bridging informal, non-formal and formal learning ............................................................................... 29
   Cultivating innovation in informal learning ........................................................................................... 30

7. Conclusion and considerations for practice ........................................................................................... 31

References .................................................................................................................................................... 32
1. Introduction

In 2009, the British Museum and Samsung Electronics signed a five-year partnership agreement to develop a range of new digital learning programmes for the museum’s family and school audiences. The programmes were offered through the Samsung Digital Discovery Centre (SDDC), opened in March 2009. Within the first five years after its opening, the SDDC welcomed more than 51,000 participants aged three to 18 years old, and around 5,000 schools every year. In 2013 the Samsung sponsorship was renewed for another five years, including a provision of new digital technologies to support the Centre’s aims for expanding and improving its educational offer.

This study set out to understand how a museum digital learning centre such as the SDDC responds to growing societal needs for lifelong learning and development of skills and aptitudes in venues and spaces that are no longer confined to formal education establishments. In particular, it aimed to shed light on the instructional design approaches and digital interaction patterns that proved effective and can inspire future museum-based digital learning practices. The research was conducted at a moment when the SDDC had just embarked on the second stage of the sponsorship period. Having reflected on the achievements and challenges of the first years, plans were renewed and made more ambitious to include the offering of more engaging educational experiences, and reaching out to a greater number of schools. This was a timely moment therefore to look at the way the Centre managers go about constantly renewing and revising their approaches in response to different factors: requests for new skills in society, changes in the national curriculum for schools, or the provision of new technologies affording different interaction patterns.

The analysis positions the Samsung Centre as an actor in a diverse and complex ecology of learning opportunities offered by formal and informal education providers. Supporting a culture of lifelong learning boils down to creating meaningful links and connections on the one hand with the learners, and on the other with other actors involved in the educational landscape – schools, policy-makers and agencies that ensure access to good education at a local level. Within this ecology, the Centre cultivates innovation by offering experiential learning engagements in which digital technology is integrated thoughtfully, informed by principles pertaining to object-based and participatory learning.

After a description of study concepts and methods and the SDDC educational offer, the report offers a structured analysis and interpretation in three parts:

- Section 4 shows how the SDDC learning activities are linked to essential knowledge and skill areas for lifelong learning, and then goes on to outline the principles and strategies that underpin the design and facilitation of learning activities.
- Section 5 focuses on the role of digital technology in learning activities. Starting from the idea of using technology as a tool, it distils a series of digital interaction patterns and shows how these are conducive to learning outcomes. Further, it reviews a series of challenges and unexpected happenings around technology integration and offers insights from the SDDC experience for working through and around these.
- Section 6 looks at the impacts of the SDDC, arguing that beyond quantifiable impacts, the Centre contributes to spearheading innovation in informal learning and creating a culture of learning in museums by targeting the acquisition of key competences and creating a bond to the lifelong learner.

The concluding section distils considerations that can inspire and inform further practice in museum-based digital learning.
2. Study methods and concepts

Research questions

The research was designed to answer the following questions:

1. To what extent and how does the SDDC support lifelong learning?
2. How do SDDC informal education programmes support, complement and enhance formal education practices?
3. What strategies and approaches underpin the integration of digital technologies in the informal education activities offered, and to what effect?
4. Within what parameters and constraints, how, and with what impacts does the SDDC cultivate innovation in informal education?

Concepts and approach

The concepts of lifelong learning, informal education, and formal/informal learning are central to this inquiry. There are abundant and often contradictory definitions and theories around these terms. Covering these debates is beyond the scope of this report, and the sections below explain the approach taken in this study to defining and relating them.

The premise of lifelong learning is that to succeed in today’s society individuals have to pursue learning constantly and in a self-directed way throughout their lifetime, within and beyond formal education. Engaging in constant vocational and professional development is crucial for keeping oneself updated and upgrading one’s skills to match the requirements of a society and job market in constant evolution (Sharples, 2000). For this research, lifelong learning is defined as the pursuit of learning at all life stages, driven and directed by the individual (Hooper-Greenhill and Moussouri, 2000). It does not cover only adult learning, but takes place from pre-school years, when the motivation, abilities, and predispositions that lay the foundations for self-directed lifelong learning can be cultivated (Faure, 1972; Hooper-Greenhill and Moussouri, 2000; Sharples, 2000).

Lifelong learning has been adopted as a framework for policies and programmes at European level (see the European Commission’s 2001 Communication Making a European Area of Lifelong Learning a Reality) and also in some European nations, including the UK. The UK Government’s Green Paper The learning age: A renaissance for Britain (1998) lays out a rationale for adopting lifelong learning as a framework for ensuring the training of a “well-educated, well-equipped and adaptable workforce” that can keep step with the growing and constantly evolving sets of knowledge and skills required for the jobs of the new economy. Even more ambitiously, the paper argues:

“Our vision of the Learning Age is about more than employment. The development of a culture of learning will help to build a united society, assist in the creation of personal independence, and encourage our creativity and innovation.” (Secretary of State for Education and Employment, 1998)

Developing lifelong learning as a culture of learning implies encouraging on the one hand its pursuit by individuals, and on the other the provision of opportunities, tools, and infrastructures for enabling individuals to access learning anytime, anywhere, across the continuum formal, non-formal and informal learning (European Commission, 2001):

- **Formal learning** takes place in organised environments, is structured, has firm objectives and outcomes and typically associated with certification.
- **Informal learning**, or ‘learning by experience’ is unstructured, often unintentional and results from day to day interactions and activities at work or in social circles.
- **Non-formal learning** is an intermediary concept, designating learning that is intentional and taking place through programmes and activities that are planned, but
are taking place outside formal education environments and normally do not lead to any credentials (European Commission, 2001; Werquin, 2010).

Learning in museums is usually referred to generically as informal learning in the bulk of related literature. However, using the definition introduced, it is more appropriate to look at it as covering different instances on the continuum informal – non-formal learning, offering structured and unstructured learning activities, some pursued intentionally and some unintentionally by visitors. For instance, learning is unintentional when a group of visitors attend an arts exhibition for passing some time together, yet at the same time they learn about specific artists and arts concepts such as Impressionism. The programmes developed by museum education departments, on the other hand, often have structured objectives and defined learning outcomes, especially when they address school audiences. These activities are closer to the non-formal side of the continuum.

In relating museum learning to lifelong learning, two aspects deserve attention. First, the process, bringing about the notion of learning styles; and second the learning outcomes. The nature and the outcomes of learning in museums are different from the learning taking place in formal educational settings. Active construction of meaning from experience, rather than merely acquisition of knowledge and skills, are at the centre of museum learning (Hein, 2006; Hooper-Greenhill and Moussouri, 2000). A definition which captures the centrality of experience and meaning-making has been advanced by the UK Campaign for Learning and adopted in the Inspiring learning for all framework developed by the UK Museums, Libraries and Archives Council (MLA):

Learning is a process of active engagement with experience. It is what people do when they want to make sense of the world. It may involve increase in or deepening of skills, knowledge, understanding, values, feelings, attitudes and the capacity to reflect. Effective learning leads to change, development and the desire to learn more. (UK Campaign for Learning)

Experiential learning frameworks recognize that all learners are different, and on this basis museum activities respond to diverse interests, prior knowledge, and ways of learning. Different learning theories have been used to inform museum education research and develop exhibits and activities. In this study, the SDDC instructional design approach has been examined in relation to Kolb’s model of experiential learning and the notion of learning styles, drawing on a framework modelled following Gardner’s theory of multiple intelligences. Kolb’s experiential learning model (2015/1984) evidences two ways of engaging with an experience: concrete experience and abstract conceptualisation; and two ways of transforming experience: reflective observation and active experimentation. Experiential learning is thought as a process going through all four stages, in a cycle of experience, observation, conceptualisation, and experimentation. Yet different learners may prefer or engage better with specific stages of this cycle. For instance, hands-on learning privileges a combination of concrete experience and active experiment; while some people engage better with theory application into practice, putting together abstract conceptualisation and reflective observation; or learn better in settings which involve a concrete experience and a reflective observation of experience, for instance while examining an experience in a group discussion.

Howard Gardner’s theory of multiple intelligences (1983) had a profound and still very vibrant influence on education, and has been specifically adopted in many museums to inform the design of exhibitions and learning activities. The theory posits that humans understand the world and construct meaning from experience differently, using and developing eight intelligences: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal and naturalist. The theory has been used as an analytical and design tool for museum education. For instance, learning activities can be designed to both stimulate and develop visual intelligence (Hooper-Greenhill and Moussouri, 2000).
The question of process is also central to assessing the outcomes of museum learning. As Hein (1995) argues, if we look at museum learning in a constructivist vein (“how the learner constructs meaning out of experience”), then to understand the nature of the learning taking place it is crucial to examine the activities of the learner, and how they formulate their own understandings from the museum experience. There are several frameworks and approaches for assessing learning outcomes for informal or non-formal learning, for instance the Generic Learning Outcomes Framework developed within the *Inspiring Learning for All* framework for assessing learning impacts in museums, archives and libraries (Hooper-Greenhill et al., 2003; inspiringlearningforall.gov.uk). For this research, the aim was not to conduct a formalised assessment, but to understand how the prefigured outcomes of SDDC learning experiences can be linked to lifelong learning. To this purpose, the study makes reference to the key competences for lifelong learning endorsed by the EC.

The recommendation *Key competences for lifelong learning* (European Parliament, 2006) defines *competences* as a combination of knowledge, skills and attitudes. Eight such competences are put forward as key to successful employment, but also for personal fulfilment, social inclusion, and active citizenship:

1. *Communication in the mother tongue*: abilities to express in written and oral form and interact with others in different contexts;
2. *Communication in foreign languages*: language abilities, but also capacities for mediation and intercultural understanding and communication;
3. *Mathematical competence and basic competences in science and technology*, including an understanding of the natural world, humans’ impact upon it and our shared responsibility towards it;
4. *Digital competence*: skills in ICT use;
5. *Learning to learn*: the capacity to structure and direct learning individually, aware of personal needs and the opportunities out there;
6. *Social and civic competences*: competences that equip individuals to take part in social life and working life, as well in civic life. This includes the knowledge of concepts such as democracy, justice, civil rights.
7. *Sense of initiative and entrepreneurship*: includes creativity and innovation skills, and the ability to identify and seize opportunities, formulate and work towards the attainment of objectives.
8. *Cultural awareness and expression*: sensibility and understanding of the value of, and the capacity to express ideas and experiences in different media and artistic forms for instance music and performing arts (European Parliament, 2006).

**Methods**

Methodologically, the study was informed by semi-structured interviews, the observation of a learning session for schools, and informative materials made available by the SDDC on their website.

Four interviews with current and former SDDC staff were conducted, including:

- The Head of Schools and Young Audiences, the team which runs the SDDC
- The current Education Managers of the Samsung digital learning programme
- A Senior Product Manager in Digital and Publishing at the British Museum who filled the position learning programmes manager during the first five years after its launch
- A museum educator and facilitator for learning sessions.
Interview guides were designed as a reflection of the main areas of inquiry outlined above. They were audio-recorded and transcribed and analysed thematically.

In addition, a digital learning session for schools was observed by the field researcher (Life after Death in Ancient Egypt, now titled Decoding Ancient Egyptian Tomb Painting). The session lasted for 90 minutes and was conducted in the SDDC. The informative material examined included reports of research conducted at the SDDC and scientific articles, as well as the information about learning activities made available online. The data available was analysed and interpreted in the light of broader trends and approaches in museum education, with a focus on the role of digital technology.

3. A venue for learning through discovery

This section outlines the place of SDDC in the British Museum, the strategic vision that animates its activities, the spaces and technologies used in learning activities and the array of learning activities offered.

The Samsung Centre in the museum ecosystem

The SDDC is part of the Schools and Young Audiences team, which is in its turn part of the museum’s broader education department, called Learning, Volunteers and Audiences. The Centre is run by a small team, made of two education managers, two weekend supervisors and several session facilitators, under the leadership of the Head of the Schools and Young Audiences team. The team is responsible with designing, managing and evaluating learning sessions and works mostly independently, however it embraces the principles and works as well in close cooperation with the Schools and Young Audiences and the Learning departments for developing special programmes and activities.

The SDDC has a distinctive place in the Learning department, delineated by its focus on digital and the core audiences it addresses – families and schools. At the same time, it is aligned to the strategic vision of the Learning department, which dwells on two key principles: the focus on the collection and providing meaningful ways of accessing and engaging with it; and visitor-centeredness, meaning that those access and engagement strategies need to be responsive to audience profiles, needs and interests. These two principles are declined in four strategic aims, which the SDDC helps to fulfil as follows:

1. Broadening access to museum collections: The Centre addresses schools and families. It aims as well to attract those audiences that may demonstrate lack of interest in museums, such as teenagers. Also, programmes are free, which means that disadvantaged schools and audiences can join in.

2. Deepening engagement: This is one of the strongest value added points brought by the SDDC. The use of digital technologies combined with pedagogical approaches that value participation and inquiry-based learning contribute to offering new ways of engaging with museum collections.

3. Ensuring sustainability: This is about ensuring that the approaches and programmes are sustainable in the long run. For the SDDC, this reflects in thinking strategically about the role of the digital in its educational offer so that digital integration is sustainable (e.g. ensuring easy maintenance, long-term use, compatibility, cross-platform apps, etc.)

4. Advocacy. The SDDC raises the profile of the museum’s educational offer and contributes to positive word of mouth about the museum. Also sharing digital artefacts made by children reverberates in further educational practices in schools and reaches communities around schools (students, teachers, parents).
Digital learning through discovery

The Samsung Centre is about encouraging learning through discovery, an aspect which is embodied in the centre name. As one of the SDDC education managers remarks, this captures the vision on digital learning advocated by the Centre, but also the internal approach to designing and delivering learning:

“[The SDDC] has the word ‘discovery’ in it, it is important because it is encouraging not only visitors to discover and explore new things, but also on our side of things internally we’re always discovering new things about our collection and new things about technology and how we can apply technology for learning. So it’s a real living centre. And that is particularly in our family sessions. (...) It is a thriving, changing programme of events to highlight new finds, new thoughts and new technologies.” (Interview with SDDC Learning Programmes Manager, 23/07/15)

The digital has an important part to play in taking this approach: digital technologies are used to deepen engagement and deliver activities which support playful, interactive and collaborative learning. At the same time, the digital is not an end in itself, it is a tool whose role is to support greater engagement and access while not overshadowing the collection and the learning content. To enable digital learning through discovery, the SDDC team adopts pedagogical approaches and engagement strategies that make the best of technology potential, particularly derived from constructivism, participatory learning and inquiry-based learning theories.

Spaces and technologies

The SDDC physical location consists of a digital studio equipped for hosting digital learning sessions. Moreover, many SDDC sessions are designed to include exploration in the museum galleries, apart from studio-based activities. The technological infrastructure and tools are therefore fit for supporting both studio-based work and gallery explorations. In 2011, the range of technologies included laptops, Android smart phones, a smartboard, still cameras and HD video cameras, audio recording equipment, 3D television, and a green screen. In 2013, when Samsung renewed its sponsorship for another five years, new more sophisticated technologies were added, including Galaxy tablet devices. The provision was made for trying out and experimenting with new technologies, but also to respond to the 2014 changes in the English national curriculum. One of the chief changes was within the Computing curriculum, which expects a more solid digital literacy basis, including learning how to code during primary school.

In the galleries, technologies are used for media capture, close examination of objects or mobile-guided gallery trails punctuated by games and quizzes. The supporting devices are mobile phones, tablets, audio and video recorders and digital cameras. Activities in the digital studio are, on the other hand, focused on content editing and composition using laptops, mobile phones or tablets, or content visualisation using the smartboard or 3D television. The studio also includes a green screen, which is used in some sessions to produce digital photographs and videos in which participants are featured in imagery displayed on museum objects.

The educational offer

SDDC offers digital learning sessions free of charge for schools and families. It also addresses teenagers aged 13 to 19 as a category on its own. The sessions focus on one or more cultural areas covered by the museum collections, and including Ancient Egypt, Asia, Ancient Rome, Ancient Greece, pre-Columbian civilisations in the Americas, and Africa.
School sessions come in three formats: full-day (lasting from 10.30 to 14.00 with lunch break), 90 minutes or self-led sessions. Sessions are offered during the scholarly year, and are designed to support subjects or areas of the English national curriculum, targeted at specific class levels or Key Stages\(^1\). For instance, curricular subjects commonly targeted by SDDC learning activities include History, Geography, Religious Education, Music, Art and Design, and Computing. The SDDC has a growing KS1 and early years audience, and is currently developing its provision for secondary school level. Special sessions are offered for students with Special Educational Needs (SEN). Teachers have to book the sessions in advance. Support sheets are provided online for each session, which describe the session aims and outline, the curricular areas it covers, the key themes and vocabulary introduced, and give tips, ideas and resources for teachers to prepare for the session or to follow up on it.

Family sessions are offered during weekends. They last from 30 minutes to two hours, and can be conducted in the galleries, in the SDDC digital studio or a combination of these. Just like for school sessions, they come in workshop format, led by a facilitator, or can be self-led. Sessions address kids over five, over seven or teens. The themes explored are diverse and constantly updated, and focus on engaging with British Museum collections in playful ways. Of special interest are the Innovation Labs. Launched in the summer of 2015, Innovation Labs are experimental spaces where families are invited to try out a new technology, a new approach, or are involved in activities designed in collaboration with a new creative partner. Families are not pre-selected, as the team wants to ensure that activities are innovative and experimental, but also suitable for regular audiences.

Teen sessions are offered during weekends. Their subjects are chosen to reflect areas of interest for teens, for instance 3D scanning, animation, or photography.

The range of activities offered is regularly evaluated and reflected upon. In response to this evaluation, the offer for all audience is revised, renewed and added to where necessary to ensure that it continues to be innovative, inspire and engage all audiences.

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\(^1\) The English national curriculum is organised around key stages (KS), as follows:
- Early years (3 to 5 y.o.)
- KS1 (School years 1-2; 5 to 7 y.o.)
- KS2 (School years 3-6; 7 to 11 y.o.)
- KS3 (School years 7-9; 11-14 y.o.)
- KS4 (School years 10-11; 14 to 16 y.o.)

Source: https://www.gov.uk/national-curriculum/overview
4. Learning content and design approach

This section outlines how the SDDC activities are designed, covering the knowledge and skill areas targeted and the approach to designing learning sessions.

Knowledge and skill areas

The Centre aims to cater for those sets of knowledge and skills that are recognized as important in society and, in the case of schools, by the English national curriculum. All learning activities are collection-focused and designed to enable participants to engage and interact in new, meaningful ways with the museum objects. As the Head of Schools and Young Audiences remarks: “It’s all about trying to increase access and understanding of our collections and our temporary exhibitions for our audiences. This is at the heart of everything. Everything is around objects.” (Interview, 23/07/15).

Learning activities explore content related to one or more cultural areas covered by the museum collections. Most sessions focus on a specific culture or cultural area, while some take a comparative perspective to examine objects, events or customs in different areas. For instance, the school session *Clothes from around the world* invites Early Years and KS1 students to playfully examine traditional clothing from different world regions, dress up, and
take digital photographs. The session *Around the world in a day* focuses on objects designed at the same moment in time in five different ancient cultures. Students then choose an object and create a multimedia broadcast about it.

Some cultural areas, in particular Ancient Egypt and Ancient Greece, have a particular appeal for audiences. This is due to the importance and fame of objects in these collections (e.g. Ancient Egyptian objects, the mummies, and the Parthenon sculptures), but also because they relate to subjects taught in the English curriculum, such as History. While the SDDC offers various sessions covering these areas, efforts are made to attract interest towards other areas of the collection as well, linking meaningfully with the school curriculum. For instance, the session *Music of Africa* links to Music and Computing curricular areas for KS1. Children listen to African music, handle and play African musical instruments, and record and edit a short piece of music. At the same time, they are introduced to key topics about African geography and cultural life, getting to examine differences in cultural celebrations in different regions of Africa. Offered since 2009, the session *Symbols and statues in Buddhist belief* managed to attract teachers’ attention towards an area of the collection (Ancient India) which did not have the level of appeal that Ancient Egypt and Ancient Greece had. The session targets the curricular areas of Religious education and Computing for KS2 students. It introduces key concepts about Buddhism and the life of Buddha, as well as building skills in digital video, digital photography and multimedia presentation design.

The range of skills and competences targeted include:

- Applied manual skills such as drawing, object design, or playing a musical instrument;
- Digital literacy skills, going from abilities to use certain devices and software (e.g. video production, video editing, 3D animation and printing) to more generic digital and information literacy competences, for instance capacity to review critically, select and employ information for a desired purpose;
- Life and career skills such as creativity and collaborative, social interaction and group work skills.

Fig. 2. 3D model of Egyptian artefact, created during a 3D scanning session.

It is important to state that the SDDC does not aim towards a comprehensive building of skills which can take years to perfect. Sessions are short, compact, and intense moments when
diverse skills already possessed to some extent by participants can be honed, expanded, or strengthened. Differently, the bases of new skills are laid that can therefore be enhanced in future learning engagements.

The skill areas are periodically revised, to keep aligned to social and technological advancements and their impacts on requirements for new skills and competences. To this purpose, the SDDC managers take guidance from published documents 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). For instance, the SDDC was quick to follow up on the increasing interest in design and making, and have begun to explore the challenges of big data.

We know that big data is going to be a really important area for schools in terms of developing skills for young people to take into the workplace. There is a kind of skills deficit in terms of data visualisation, data analysis and data communication at the moment, and organisations like NESTA and the government are looking to see how that skills gap can be filled. We want to be part of that conversation by testing out a data type of session with secondary school students. (Interview with SDDC Learning Programmes Manager, 23/07/15)

Alignment to trends does not preclude keeping the focus on the museum’s collection, as one of the learning programmes managers explains:

Our programme and our learning department is all about deepening engagement with the British Museum collections. So we would only do a data type of session if it was significant, if it helped to achieve that aim, if it helped to deepen engagement with our collections. We think that there is definitely potential there because the museum is a place of data, we have eight million objects, I think maybe two million of those have information, detailed information about them so that's one kind of dataset, and there are all sorts of datasets in the museum, so we think it does have that potential to meet aims of teachers but also enhance understanding of our collections. (Interview with SDDC Learning Programmes Manager, 23/07/15)

Design principles and strategies

The design of learning activities abides by a series of common considerations and design principles, which ensures that the SDDC educational offer is coherent and consistent with the museum’s broader offer and the vision that animates the Centre’s activities. These principles are further listed and commented below.

1. An object-based learning framework
2. Learning through participation
3. Modelling activities around audience profiles
4. Catering for different learning styles
5. Technology as tool
6. Experimentation, iteration and constant improvement

An object-based learning framework

In an object-based learning framework, museum objects are used as links for accessing the vast amount of knowledge about the ways of life, culture, and history of the populations whose traces are present in the British Museum. Objects, therefore, provide a tangible evidence of a historical era, an event, a setting or a character. This link can be used in several ways in the design of sessions: to drive students’ interest and curiosity; prompt them to look closely, examine and investigate the meanings associated with object features and imagery; imagine the use of the object in its original location; or discuss, debate and work in groups to shed light on and interpret its meanings. The focus on objects also inspires rewarding activities which involve content production. For instance, in Make a mosaic mask, families can design a mosaic mask on tablets, inspired by Aztec gods, print it and take it
Similarly, in *Every drawing tells a story*, families look closely at objects from the museum handling collection and create drawings using special software on tablets and smartphones. Sessions using green screen technology invite families to see how it feels to be represented on objects or scenarios that reflect the museum collection.

**Learning through participation**

Learning activities are modelled following the principles of participatory learning, constructivism and inquiry-based learning theories. Central to these theories is the acknowledgement that the learners bring their own knowledge base, assumptions, but also interests and a propensity to learn in a particular way. The theories recognize that “learning is a collaborative activity between the instructor and the learner and that both are bringing valuable tools and background knowledge to the activity. That it is not strictly just the instructor or the teacher teaching, pouring their knowledge into empty vessels.” (Interview with former SDDC Learning Programmes Manager, 20/06/15).

In the framework created by these theories, the museum and its educators step back in the role of facilitators, who create the right opportunities, stimuli and tools for learning experiences to happen. The role of the facilitator is essential not in a directive, but in a supportive though not less significant way. Differently from the traditional authoritarian figure of an educator or instructor who transmits knowledge, the facilitator’s main part is in “mediating and facilitating some sort of creative response on the part of the young people” (Interview with former SDDC Learning Programmes Manager, 20/06/15).

Activities are designed to encourage participants to explore actively, ask questions, and discover rather than being offered ready-made answers and information. Talking at, and offering ready-made answers are avoided.

> We are very aware that we are not a formal education institution, we are not a school and being a museum education provider means that we are able to play around with those possibilities of how it is best to teach and how it is best for others to learn. So, we would like to get away from some of the slightly more traditional 'teacher stands at the front imparting knowledge'. And of course there is a place for the educator and there are certain elements that do need to go across but we are really trying to examine how we can do that and how it is best to make sure that all different types of learning styles are catered for. (Interview with SDDC Learning Programmes Manager, 23/07/15)

As one of the session facilitators remarks, this approach shifts the focus from the educator to the child, and encourages them to find their own answers:

> It really should follow the children's lead in a way, so that they are involved, that they are making their own decisions, (...) they are actually doing the things and finding out for themselves. (...) And just getting groups to communicate, getting children to work in groups, getting them to find out ideas, getting them to think and questioning is very important. (...) Giving them ownership over what they do. (Interview with SDDC Museum educator, 23/07/15)

**Modelling activities around audience profiles**

While object-based learning and the participatory approach apply for all audiences engaged in SDDC activities, the content, activities and the type of engagement are defined and modelled according to the developmental stage and the audiences addressed.

**School sessions** are conceived as complementary learning activities to the scholarly curriculum. They address a particular school level or Key Stage, and have clearly defined learning goals and outcomes aligned to curricular areas. To ensure that school sessions are aligned to the curriculum, the SDDC team carefully reviews the curriculum for the KS or area targeted. Advisory panels including teachers are also consulted as part of the design process.
While there is a firm link to the curriculum, there is also an important element of novelty: SDDC activities offer new perspectives and approaches, or the opportunity to engage with materials and content that are not available in schools or not commonly used in school learning.

*For schools, what we are looking to do is better serve schools and teachers to help them deliver the curriculum with us. And increase their understanding of how object-based learning can facilitate learning, for them. (...) And with teachers as well, it is about skilling them up and building their capacity to use objects.* (Interview with the Head of Schools and Young Audiences, 23/07/15)

The SDDC also offers school audiences an opportunity to work with digital technology that is often not available in their premises, and help children build digital literacy and digital production skills. Apart from content areas in disciplines such as History, Geography or Religious education, sessions commonly target skills in Computing, ranging from learning video and audio production techniques to designing and producing multimedia presentations.

![Fig. 3. School children in the galleries and in the SDDC digital studio.](image)

At the same time, sessions account for very brief learning episodes. It becomes important therefore to provide some clues for teachers to integrate and follow up on the sessions in their teaching practice. This is done by making available online support notes for teachers, which they can consult before booking an activity. The notes indicate how teachers can prepare for a session, and how they can follow up on a session. Moreover, most activities result in a creative output, usually produced in groups of students. Outputs are sent back to schools in digital or analogue format. These are often examined in the classroom after a session, and in some cases used for events where parents can be invited.

Engagement patterns are also designed differently according to the developmental stage. For instance, hands-on manipulation and kinaesthetic learning are favoured approaches for Early Years students. Whereas students in KS1 and 2 have a natural curiosity and are eager to listen to adults, ask questions, and inquire actively into a subject. These inclinations are taken into account in the design of sessions that blend Q&A and inquiry-based content exploration.

**Sessions for families** are designed to inspire and support learning in fun and engaging ways. As the Head of *Schools and Young Audiences* points out, an important aspect when proposing sessions for families is to make the museum feel like a welcoming space, where families are comfortable about exploring and learning at their own rhythm and in their own style:

*A lot of it is about making the museum feel like approachable. And that families belong here. It is about creating and inspiring delightful sessions for families when they come to the museum. But treating them like an important learner too in their own way. Families learn in*
different ways, very fun, creative, aesthetic. In different ways from what people think of as traditional learning in terms of acquiring knowledge. (Interview, 23/07/15)

![Image](image.jpg)

**Fig. 4.** Marker scanning during the session *Passport to the afterlife, a mobile Augmented Reality trail for families.*

To do this, sessions are conceived to invite families and young children to try out, get involved in first person, explore the galleries in game-like activities, use recording devices to create digital content, recreate historical designs or drawings, or create their own exploration trails in the galleries. Hands-on manipulation and making are an important component. In the session *Shadow puppets animation,* families get hands on to decorate puppets in the ancient Javanese tradition of shadow puppetry. Thereafter, they use voice and video recording to create short films with their puppets. Similarly, in *Animate Celtic craft,* families recreate Celtic designs using different materials, and then make a digital animation.

Importantly, sessions are designed to involve the family as a whole rather than children alone. Children and adults are encouraged to work, explore, and create together. In more complex activities, tasks can be split among parents and children.

**Teen sessions** stand out in the SDDC educational offer for the alternative approaches to engagement and facilitation of learning. As a former SDDC education manager explains, teens are at a moment in their life when they question, even defy authority figures, and resent being directed and taught in an authoritative way. They may have little interest in material culture, or what the museum has to offer. Instead, they are much more preoccupied with understanding themselves, struggling to find and express an identity and come to grasps with decisions about their future. In response to these characteristics, teen sessions are designed to take the teenagers’ point of view. While they may be less interested in the museum as a venue for access to material culture, teens are interested in the experience that such a venue can provide, especially if it ties in with their interests. SDDC sessions therefore are highly experiential, and give attention to process as much as they do to content.
Second, sessions are conceived to link to areas that are interesting for teens and are furthering teenagers’ agenda rather than imposing the museum’s agenda. For example, in the session *Teens 3D scanning skills workshop*, teens aged 15 to 18 learn about the use of 3D scanning in museums, enhance their 3D scanning skills and make their own 3D scan. In the session *Teens timelapse animation skills workshop* teens aged 13 to 15 learn to use stop-motion animation software under the guidance of a professional animator, working to animate clocks in the British Museum’s collection.

Thirdly, facilitation is modelled on a master-apprentice type of interaction which was found to be particularly rewarding for engaging teens.

Recognizing the developmental stage where teenagers are, they are looking to make connections with adults not as instructor and student but as almost like master-apprentice. They want to see adults who are engaged in activities that the adults find truly satisfying, people who are passionate, creative professionals who are passionate about their work. And through an encounter, and through an encounter and ideally through some sort of making or creating, again participatory learning experience, teenagers then come to recognize, come to learn something about an area of the creative arts and particularly the way in which creative arts practitioners look at the world and see the world that they hadn’t before. (Interview with former SDDC Learning Programmes Manager, 20/06/15)

**Catering for different learning styles**

One of the advantages of using digital technology in a participatory learning paradigm is that activities can be designed to support different learning styles:

*Participatory learning is about creating, facilitating, making with the assumption that learning happens through that type of engagement and participation. That type of learning better applies to different learning styles as opposed to only supporting verbal learners who are often favoured in schools and in school curriculums. Because so much of school learning is*
focused on reading and writing and reports. The nature of school work very often prejudices the verbal learners. Whereas the moment you come out of the classroom, in any context, there is suddenly the possibility and opportunity to engage learners that have different styles. (Interview with former SDDC Learning Programmes Manager, 20/06/15)

Many SDDC sessions offer opportunities for engaging with learning content that emulates Kolb’s experiential learning cycle (2015/1984, see Section 2). For instance, some school sessions are designed as a combination of gallery-based observation of objects, guided by games, quizzes and digital content capture; and studio-based work in which students manipulate, edit and compose multimedia artefacts drawing on their experience. These sessions are designed to offer opportunities for children to engage with learning content in different ways along the experience continuum, often repeating or going to the same piece of content or material and handling it from different sides, for instance: observing an object, learning about the history of the object through a video, recording stories or impressions about the object and back to the studio creating multimedia narratives or posters about that object.

SDDC sessions also support alternative learning modalities, and in particular visual, kinaesthetic, and social learning. Sessions are periodically reviewed to make certain that different learning styles are accommodated.

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. So if there was a session that we felt maybe there was too much of a focus on the teacher talking to the whole group, we would then kind of sub-divide it and develop it so there was more group work integrated. So say you were a student that learns well by themselves, or you were a student that learns best in pairs, or one in a group of four or five. You would have the opportunity to learn that subject in all of those different social settings. (Interview with SDDC Learning Programmes Manager, 23/07/15)

Social learning is supported in most learning activities which have a component of group work related to either exploration, making and building together, or debate and discussions on the outcomes of creative activities.

Particularly rewarding is the use of Augmented Reality (AR) technology for visual and kinaesthetic learning. AR interaction motions close attention to space and objects – real and virtual – and through different challenges and games encourages the user to identify shapes and layers, match parts, complete an image, or decode symbols and graphics. For instance, the AR app A gift for Athena is used by KS2 students to explore interactively and playfully the Parthenon sculptures. Different games and challenges are embedded in the app which appeal to the visual sense and processing of visual information: for instance recognizing the different layers in a Parthenon sculpture, or matching a sculpture to its place in the Parthenon architecture(see Text box 4 below).

Technology as tool

Digital is central to the Samsung Centre’s educational offer, yet its integration is never motivated by the mere intention to use a new device, software or app. Technology is used strategically as a tool to enable new ways of engaging and interacting with the museum collections. The emphasis is less on the technology per se, and more on the interaction styles it affords, and how these can be integrated in the design of learning sessions that encourage participants to ask questions, examine and learn about the collection. As the Head of Schools and Young Audiences remarks, “digital should work best if used where it is best, where it can enhance sessions. And we know what digital works well for, for instance collaboration, co-
creation, for sharing, for differentiation and personalisation of learning. So we should be using it where it is strongest for our audiences.” (Interview, 23/07/15).

Digital interaction and mediation are particularly rewarding when employed in a framework informed by constructivism and participatory learning. Technology then becomes an actor in an experiential learning framework where teachers or instructors become facilitators, and students take the lead in pursuing and leading their learning experience through inquiry, exploration and making. Some of the digital interaction patterns modelled within this framework are described in Section 5.

**Experimentation, iteration and constant improvement**

The SDDC configures its educational offer dynamically to respond to the social mission of the museum, the relevant trends in society and education, and the evolving needs of its audiences. The instructional design is informed by Lean and Agile methodologies, both of which are swift, responsive, and have iteration and constant improvement at the heart of their approach. Lean methodology is customer-centric, emphasises the importance of delivering value defined from the customer's point of view, simplicity in working and eliminating unnecessary workload or product features (termed ‘waste’), and a constant drive towards perfection through iteration. Agile development methodology advocates product development in short work cycles, called iterations or sprints, providing a chance to periodically assess goals against the progress made and thus make the development process responsive in real time to factors and challenges not evident at the start.

Inspired by these methodologies, the SDDC approach to design is responsive and dynamic. When first offered, learning sessions are iterated a few times, and feedback is integrated from participants until reaching a formula that meets expectations. Once sessions are integrated in the regular offer, they continue to be improved. At the same time, they also have to account for a series of constraints, especially for schools. Since school session are advertised online and accompanied by support notes that describe them in some detail, they cannot be updated very often. The team may gather feedback and even re-design sessions, but except minor changes they will have to wait until the end of the school year to implement significant changes. As different from school sessions, the family sessions are not dependent on a curriculum, have fewer design constraints and can be changed more often. They are rolled out every two months, and there is greater space for experimentation and updating.

Feedback for improving sessions is gathered through evaluation and the observation of sessions by SDDC education managers. The main means of evaluation is through forms filled out by teachers at the end of a session. Several other means have been used in the past to gather feedback, for instance gathering the opinions of older students, or examining the artefacts produced by participants. At the moment the SDDC education managers are looking to change and improve their evaluation methodology. One goal is to introduce evaluation as part of the session itself, embedded in the learning experience. There are plans to also do evaluation with the students involved on a larger scale.

To be able to make good use of technology and respond to social trends, it is important as well to be on the look out for the way technologies are used in education and social life outside the museum. New technologies and interaction styles that are attractive to target audiences are reviewed to ensure that the way the activities are designed speak the language of the audience addressed, and present an appeal.

*We should also be learning a lot, digital is so much part of our everyday lives now, it's how we communicate, it's how we interact with each other. I think museums need to really understand how technology is used outside of museums as well, how people are interacting with a particular technology. How do social media work for families, and how is that translated in a museum context? I think this is really important to understand, to be able to use those kinds*
of similar techniques, but within the museum. (Interview with the Head of Schools and Young Audiences, 23/07/15)

5. Modelling digital interaction for object-based learning

Digital interaction patterns

In the SDDC approach, technology is used as a tool in a learning framework that is defined jointly by:

- The focus on the collection, therefore aligning to an object-based learning framework;
- Constructivist, participatory learning and inquiry-based learning theories.

The definition of learning goals, learning content areas, and skills development targets thus contributes to configuring a structure in which digital interaction patterns are integrated. A series of key digital interaction patterns have been distilled from the SDDC experience. They do not exhaust the range of interaction patterns used in learning activities, which is configured dynamically and refined through experience and integration of different technologies. Rather, these patterns are used to examine how technology is used concretely as a tool to support a certain activity (e.g. gallery exploration), a learning style (e.g. visual learning) or bring about a learning outcome (e.g. collaborative skills). Most learning activities employ several of these patterns, blended in frameworks with clearly stipulated learning goals. Patterns are listed in no particular order, though the first two – creative engagement and digital content visualisation and exploration tend to be among the most widely employed and versatile patterns:

Technology as tool for …

1. ... creative engagement
2. ... digital content visualisation and exploration
3. ... guided gallery trails
4. ... visual learning
5. ... collaboration and social learning

1. Creative engagement

When using technology as a creative tool, there are two essential moments that can be modelled into learning experiences: capture and creation. Capture refers to the production of digital content through a variety of means, including voice recording, digital photography, video recording, etc. It can also involve students recording themselves or being recorded when engaging in a performative or a making activity such as drawing. Capture brings value for learning both as process and product. The process of capturing, like in recording one's voice, or taking digital photographs of museum artefacts, heightens the level of attention and engagement, more so when capture moments are integrated in more complex tasks, for instance gallery trails structured through games and quizzes. The product, the digital artefact created, offers a way of keeping track of the experience, it provides a record which can be used in different ways after the capture moment: it can be safe kept for memory, it can be examined to understand better the experience or look closely at the objects captured, or it can be manipulated and edited to produce an elaborate multimedia artefact.

Creation refers to the manipulation, editing, and composition of digital content. It can be done with ready-made media assets and digital content, or with content captured by students themselves, or by someone else recording a student activity. Creation activities are very varied, and both ask for and enhance different skills, ranging from audio editing to video editing and abilities to use a digital authoring tool. Some creative sessions aim to impart skills
in using specialised software or hone advanced digital editing competences such as 3D scanning or 3D animation.

![Image of comics created with imagery from Egyptian tombs.]

**Fig. 6.** Comics created with imagery from Egyptian tombs.

The capture-creation pattern is used in several SDDC sessions as a framework for blending gallery exploration with studio-based work—a macro-structure for session design which has proven repeatedly to be one of the most effective formats for engaged learning.

<table>
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<tr>
<th>Text box 1. School session Symbols and statues in Buddhist belief (KS2).</th>
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The full-day workshop *Symbols and statues in Buddhist belief* (formerly called *Multimedia Magic*) links to the KS2 curricular areas of Computing (making a multimedia presentation) and Religious Education (reflecting on spiritual issues). The session introduces themes related to Buddhism and the life of Buddha and aims to build skills in digital photography and video and making effective multimedia presentations.

The session is modelled around a capture-creation framework, bringing together guided gallery exploration and studio-based creative work. Students gather in the Ancient India Gallery to receive a brief introduction to the themes and activities of the day, and then split into groups and use a tablet computer to explore the gallery in a structured way. A multimedia presentation on the tablet provides children with information about the life of Buddha and Buddhist religion and prompts them to engage in different activities, working in groups. The tasks on the multimedia trail prompt students to look closely at objects, in order to identify those that resemble pictures in the presentation. Different content capture tasks are included: making an audio recording about one’s favourite Buddha; working in pairs to make a video about generosity and being generous; analyse the Buddha’s smile and take pictures of each other trying to smile like the Buddha; and making a video of a Buddhist stupa while circling it.

Once the digital content is captured, students break for lunch and reunite in the SDDC digital studio. The afternoon session starts with a debriefing on the morning activities. Students discuss the concepts and the objects that they have explored during their gallery visit. They receive a crash course in using the multimedia authoring tool *Glogster* and then work in groups to build a multimedia presentation using the media assets created during the morning.
Two-three presentations are screened at the end of the session, and all outputs are sent to schools after the session. (Read a detailed analysis of this session and its learning impacts in Doll, 2012)

2. Digital content visualisation and exploration

Digital technology is particularly rewarding for object-based learning, as it enables different ways to recreate or evoke context around the objects studied. Digital media can be used to portray historical reconstructions of the object in use, picture its original environment, or portray stories and events that link to the object. The exploration of digital content can be done on different devices, and integrated in individual and group work, or for whole-class activities in the case of schools. In the SDDC, digital content is delivered in the studio via 3D television, laptops, and a smartboard, and via mobile technology (tablets and mobile phones) during gallery visits. An effective way to use digital content exploration is to integrate small snippets of information especially in audio-visual format in more complex tasks and activities which prompt students to take action and capture, create, or examine something closely, or discuss in groups what they have seen and understood (see Text boxes 2 and 3).

Text box 2. School session Decoding Ancient Egyptian tomb painting (KS2)

Formerly known as Life after death in Ancient Egypt, this session explores Ancient Egyptian beliefs about the afterlife, and the themes of life after death, the afterlife, and the Ancient Egyptian burial practices, using imagery from Nebamun’s tomb, displayed in the British Museum’s Ancient Egypt galleries. The session compliments the KS2 curricular areas of History (Ancient Egypt), Computing, and Citizenship (reflecting on spiritual and cultural issues). The session lasts for 90 minutes and is held in the SDDC digital studio. While it does not include a visit to the Egyptian galleries where Nebamun’s tomb paintings are displayed, teachers are encouraged to take students to see the paintings before or after the learning session.

Activities blend elements of inquiry, exploration, digital media manipulation and content creation:

- Inquiry-based exploration of subject matter: A 3D animated film about Nebamun’s life and slides from the tomb paintings are used as triggers to challenge students to explore the themes of death and the afterlife, linking to their own experience. Visual Thinking Strategies are used by the facilitator to encourage students to explore, decipher and put forward their own interpretation of the paintings.

- Close-up visual examination: students work in groups to explore and find clues in the paintings, using mobile devices.

- Crash course for learning to use a multimedia authoring tool: Students are taught the basics of using a multimedia authoring software – Comic Life, for making comics from images.

- Digital media manipulation and content creation: Students work in groups of two or three (arranged by their teacher) and use visual media assets and pictures of themselves taken during the session to create their own version of the afterlife. Laptops or Samsung Galaxy tablets are used.

- Sharing the creative output: during the session given time shortage only one or two groups get to show their creative output to their colleagues. However, creative outputs are sent out to schools after the session, both in digital and hard copy formats.
3. Guided gallery trails

Learning sessions that are partially or entirely held in galleries often employ a thematic structure which prompts participants to follow or create a path through the gallery. Guidance can be provided through mobile devices, either tablets or mobile phones (e.g. by means of Augmented Reality apps or other apps, multimedia presentations that structure a path with tasks and activities) or by combinations of paper worksheets and mobile technology (e.g. using the mobile device to get prompts on objects to examine and tasks to complete, and then marking results on a paper worksheet). Activities blend digital and social interaction and can include: examining closely and photographing objects; identifying objects looking at pictures on the screen; recording oneself or one’s peers while speaking about a related subject; quizzes about content delivered through an app; game-like social activities using prompts or information delivered through the app, etc. (See Text boxes 3 and 4)

Text box 3. Mobile app for the temporary exhibition Hajj: Journey to the Heart of Islam (KS3-5)

Designed as a learning activity for the temporary exhibition Hajj: Journey to the Heart of Islam, this session linked to the KS3-5 curricular areas of Religious education, History and Islamic art. The learning aims were to enable students to understand the importance and the process of Hajj in Islamic religious thought through an experiential approach.

A native Android application was designed and developed in-house and delivered on a Samsung Galaxy smartphone to guide the exploration of the exhibition. The trail lasted for 60 minutes. Each student was provided with a Galaxy phone, but throughout the trail there were many occasions for group work and collective interaction. The app guided students into a personal journey that followed the steps of the Hajj, the pilgrimage to Mecca, along seven stages: Motivation; Preparation; Journey; Being together; the Ka’ba; Rituals of Hajj; and Impact. This structure traces the journey of a Muslim pilgrim, starting from the call or motivation to visit Mecca, and going through the ritualised activities that have to be followed throughout the journey. The emulation of this journey was an important element for involving students in first person, and evoking the experience of ‘being there’.

For each of the seven stages, activities blended exploration of multimedia content delivered through the phone with a variety of tasks and activities, both analogue and digital, that students undertook individually and in groups, and including:

- **Preparation**: Finding in the gallery images that they had to take with them as pilgrims to Mecca, and photographing them. Listening to a prayer in Arabic and then recording it reading aloud the English transcript.
- **Journey**: Teaming up in convoys to take different routes to Mecca, and drawing a *Mahmal* (ceremonial palanquin) on the smartphone.
- **Being together**: Watching videos of pilgrims to Mecca, speaking about sharing and eating together. Role-playing in groups.
- **Rituals of Hajj**: Students had to re-enact rituals using the phone or moving through the gallery. For instance, for the ritual Sai they had to correctly identify and mark on their screen the audio guide numbers of seven objects. Once the task was completed, the reward was seeing the *Zamzam* ritual bottle be filled with sacred water. For the ritual *Stoning the pillars*, students were asked to choose seven negative qualities out of a list, which they would like to give up, and then simulated on their phones throwing pebbles to pillars for each of the seven negative qualities, which made them disappear.

(Read a detailed analysis of this session and its learning impacts in Von Aesch, 2012)
4. Visual learning

Looking closely at objects is important in an object-based learning paradigm. One of the disadvantages of using digital technology is that it often detracts attention from the object, motioning it towards screens and devices. Some digital interaction activities however are designed to respond to this creatively, and instead make students more attentive to objects. For instance, in some activities students are prompted to identify objects in the gallery that match the pictures displayed on mobile devices, or engage in physical interactions inspired by object characteristics. In the session *Symbols and statues in Buddhist belief*, pairs of students are encouraged to examine the facial features of Buddha statues and try to imitate the expression and smile while taking pictures of each other. AR technology is particularly rewarding for bringing visitors closer to objects. In the teen programme *Cultures in Contact* AR technology was employed in a learning framework in which teens were first engaged in doing research around objects in the galleries, and then making short movies based on the gallery activity. AR was used to find objects in the museum, and then visualise animated 3D cubes and pictures of objects superimposed on the real objects located in the gallery space, through the live view mode of the *Junaio* AR browser. The live view mode appeared to be one of the most attractive features of the activity, keeping participants immersed and engaged. Similarly, seeing a combination of virtual objects on the screen and real objects in the gallery added to the learning experience (See more in Mannion, 2012; also *Text box 4*).

**Text box 4. Augmented Reality trails and games**

Since 2010, The SDDC experimented with the use of AR in the galleries. Different interaction modalities were tried out: marker-based AR (scanning printed markers to reveal objects on screen); location-based AR; and displaying virtual art during gallery exploration.

*Passport to the afterlife* is a family activity which challenges participants to decode spells from the Ancient Egyptian Book of the Dead. AR interaction is integrated in a two part structure:

- Families follow a trail in the Egyptian galleries with Samsung phones provided by the SDDC. They identify and scan printed markers to reveal 3D objects on the mobile phone screens. The objects represent hidden words from spells, which they collect by means of a paper worksheet.
- The information gathered is brought to the digital studio, where families are assisted to create a digital poster with spells from the Ancient Egyptian Book of the Dead.
Talking objects: Museum as object (December 2010) involved 15 teenagers in designing their own trails through the museum. After being taken on a tour of the museum by a historian, teens split into groups to design and build their own thematic trails and populate them with content through images, text and video. AR technology was used to reveal content by scanning markers, similar to Passport to the afterlife.

A gift for Athena is a mobile app created by the SDDC with the games company Gamar. The app (available for both Android and iOS) uses AR to enable students to explore the Parthenon galleries. A formal activity for schools is designed using this app, which is self-led and addresses KS2 students. The app provides an introduction to the annual Panathenaia festival, which celebrated the birth of Athena. The game invites students to be part of the festival procession. Through game-like activities and challenges, they explore the architecture of the Parthenon and the location and meanings of the sculptures. AR is used to help participants discover parts of the Parthenon that are not visible, or examine sculptures attentively. For instance, the Silhouette challenge (see vimeo.com/95501915) asks students to pay attention to the shape of a sculpture and how it fits in the building pediment. The students see an empty silhouette of a sculpture, and need to find the real sculpture in the gallery. Upon finding it, they are given more information about the sculpture. In the Collecting challenge (vimeo.com/95471372), players look for objects from the Parthenon frieze, helped by clues. Once they find an item, children have to scan it and if this proves to be correct they can see a reconstructed version of the item displayed on their screen.

5. Collaboration and social learning

Several collaboration patterns are afforded by digital media, or by combinations between digital and analogue media. Most SDDC activities have students work in groups at several stages during learning activities. They can, for instance, be teamed up around a single device to explore objects in the gallery (e.g. Text Box 1) or work in teams to simulate a journey, each
with their own mobile device (Text box 3). Working in teams serves to cultivate skills for teamwork and collaboration, as well as social interaction skills.

Grouping and group activities have different dynamics depending on whether activities are designed for families, schools or teenagers. In families, the tendency is for children to take centre-stage, while parents happily become facilitators. As Mannion (2012) remarks, this means that digital-analogue activities such as combined phone/tablet and paper worksheet activities can work well, as children tend to handle digital devices and parents can support them by completing worksheets or doing other activities that keep track of or support the child engaging in the digital activity. This can be more challenging in school groups or among teens, where controlling the device can be coveted. Research done at the SDDC suggests that to ensure smooth cooperation groups should be small (maximum 3 members) and in school activities friendship groups work better than ability groups.

In friendship groups – and this happens with families too, people within the group are happy to take on roles, to facilitate a kind of holistic experience, the group making progress towards its goal. (...) Parents are happy to take on the role like recorder, wherein they are recording information onto a worksheet, which is much less exciting than carrying the mobile phone and scanning the objects using AR. But parents are happy to do that because they recognize that they are trying to cooperate with their family members, or companions in order to accomplish something together. In friendship groups this is similar. People take on roles much more willingly, which then facilitates the learning activity. (Interview with former SDDC Learning Programmes Manager, 20/06/15)

Dealing with technical challenges and the unexpected

The experimental approach to designing learning activities means that the limits of technology are constantly tried out. This sometimes results in challenges at several levels – technology management, budgeting, maintenance, running, or practical issues with digital interaction raised during the implementation of learning sessions. The solutions and ideas to work around these challenges and move projects forward prove that creativity and a clear sense of purpose are key ingredients for ensuring successful delivery of digital learning sessions. A few examples will illustrate these points:

Mix resources for the best outcomes: When working on a new projects, it is important to have a clear idea about learning priorities, and how different resources can support the learning outcomes of the session. The AR session Passport to the afterlife integrated AR interaction into a family activity, combined with using low technology (paper worksheets) and a multimedia publishing task at the end. The session included using bespoke animated 3D objects that would be revealed through marker scanning in the galleries. In addition, models were acquired online and adapted by a freelance animator. Programming was done in-house and a free AR browser (Junaiio) was used for web hosting.

Solving creatively technical constraints or failures: A common issue is raised during sessions which require streaming in the galleries. While at present (Winter 2016) the British Museum has introduced free Wifi connection in its galleries, in the past streaming had to rely on 3G connection, which was poor in some areas of the museum. Solutions were found by limiting the sessions to gallery areas which had a strong signal. Preloading content on mobile phones before an event such as a gallery trail is another solution (Mannion, 2012).

The project Cultures in contact aimed to use location-based AR, however this was challenging because GPS positioning was not possible in the galleries. Instead, a hybrid approach was used - markers were scanned by participants to mark their position in the gallery and trigger the visualisation of virtual objects on Galaxy tablets overlayed on objects in the gallery. This solution had its own challenges, as once the user’s position was signalled, the virtual content displayed was anchored in that position, and did not adapt to the user’s
movement. The team solved the issue creatively by marking a colourful spot on the floor as the scanning position, and placing volunteers who could advise and assist teenagers explaining how it all worked.

*Accounting for group dynamics in replicating digital interaction patterns:* Some session aspects or technical features are spontaneously liked or disliked by different audiences or participants. When replicating engagement or interaction patterns, responses can be different. For instance, in *Passport to the afterlife* the combination of smartphone and paper trail worked well with families: typically children managed the phone and scanned markers, and parents followed up and marked the collected objects on the paper worksheet. In *Cultures in contact* the same combination digital device - paper worksheet was tried out in a different and more complex learning framework, and using tablets instead of phones. Questions about objects were displayed on tablet screens, while answers had to be jotted down on paper worksheets. In this case however, the intended purpose of the worksheet and tablet were confusing for teenagers, and issues were raised by collaboratively managing the task. This case was illustrative for how diverse audiences respond differently to similar interaction patterns, and pointed to the importance of carefully considering group dynamics in the design of sessions.
6. Shaping a culture of lifelong learning for young audiences

For the first time in history, education is now engaged in preparing men for a type of society that does not yet exist. (Faure, 1972: 13)

Underpinning this study has been the idea that a culture of lifelong learning dwells on two essential components. First, the willingness and commitment of the individual to lifelong learning. And second, the provision of a diverse “ecology of learning opportunities” (Sefton-Green, 2013:5) or “learning resources” (Knowles, 1981: 135-136) – formal, non-formal and informal. Bringing these two together is a matter of bridging and connecting among different actors in the educational landscape and among these and the lifelong learner. Ultimately, the learner is central in these processes: whilst presented with a variety of formal, informal and non-formal learning opportunities put forth by various institutions, each individual configures their own learning ecology, creating connections between the various offers according to personal needs, goals, interests and preferences (Sefton-Green, 2013). In this perspective, the contribution of the SDDC to lifelong learning can be seen along two axes:

1. Responding to the needs of and connecting to the lifelong learner. This can be done by catering for key competences for lifelong learning through targeted programmes, but finds its most rewarding expression in forging a bond or connection with the learner, creating an openness towards (museum) learning that can lead to numerous and evolving learning opportunities throughout one’s lifetime.

2. Bridging, connecting to and complementing the work of other actors in the educational landscape, notably formal education institutions. A very important aspect in this respect is cultivating and spreading innovation that reverberates across the formal, non-formal and informal learning continuum.

These points are further unpacked in the forthcoming parts.

Shaping key competences for lifelong learning

SDDC activities contribute to cultivating key competences for lifelong learning, which can be related to the framework endorsed by the European Commission (European Parliament, 2006).

Communication competences are at the heart of learning activities. Students are required to express and communicate ideas, at times explain or defend them, communicate well within the group to ensure they are producing a meaningful output, present their work in front of their peers, etc. Through some activities they also learn to develop messages and communicate them through digital media, or visually. Activities also encourage participants to engage with ideas, content and material that represent diverse cultural viewpoints, therefore enhancing their capacity for intercultural understanding.

Digital competence. Activities hone information and media literacy skills. Information literacy covers the abilities to access information rapidly, evaluate critically the accuracy and relevance of information, and identify the adequacy of information sources. SDDC activities cultivate these abilities through different strategies, and especially by creating learning moments when participants have to look for information, arrange, or manipulate it to craft a multimedia artefact. With respect to media literacy, learning activities may cover both media analysis and creative media production. Students learn to use digital as a tool to look for, assess, or communicate messages and information.

Learning to learn. The way the programmes are designed encourages learners to take initiative and responsibility for their learning. Learning activities are not formally tested.
Rather, students are asked to use the knowledge in immediate follow-up activities which require their utmost attention. Students not only have to pay attention, but also to be quick at converting and interpreting information. This contributes to teaching them to lead their own learning activities, and see quickly how learning has an immediate, tangible use.

**Social and civic competence.** Sessions hone social and collaboration skills: Most learning activities require participants to work in group at some point. The dynamics of group work differs according to the audience involved and the type of activity, e.g. exploring galleries, examining objects, capturing media, or designing a multimedia presentation. In all cases, however, members have to work together for a shared goal. Each member may contribute differently towards this goal, some may have a more exciting part to play, and others a support role. Yet by learning to commit to the successful delivery of a shared output, students also commit to playing their part well, and supporting the others’ contribution. They learn that what their team members do is just as important as their own part, for the outcome to be achieved. Moreover, some sessions introduce specific subjects, themes and terms related to citizenship and civic life, looking at historical examples from nations such as Ancient Greece or Ancient Egypt.

**Sense of initiative and entrepreneurship.** Several competences are cultivated in here:

*Creativity and innovation skills:* Participants are encouraged to think creatively and act on their ideas. Most learning sessions include a hands-on creative component where students are asked to ideate and produce a (digital) output which can be a video piece, a multimedia broadcast, a poster, a multimedia presentation, etc. Seeing a tangible result of their efforts enables them to link between ideas and the practical implementation of their ideas.

*Critical thinking and problem solving:* Learning sessions ask participants to engage with rather than merely receive information. Information is provided as a result of their inquiry, or can be debated in group, or becomes the foundation for a creative activity. In order to go about with creative tasks participants have to examine closely, dissect, question, reframe and complete the information available. This encourages them to think about data and information in a critical way, ask questions, debate, and recognize their own role in producing and circulating information. Some sessions are moreover designed to hone problem solving and investigation skills. In the session *Museum investigators* students learn about techniques used by museum scientists to examine objects. *Roman Britain treasure challenge*, which is conducted via video conference, is designed as a series of challenges about archaeological finds that students have to complete while working in teams, going from choosing the tools to use for archaeological excavations to decoding Roman coins.

*Time and goals management:* The nature of the SDDC activities is that they are short and contained, yet they all have clearly set goals, often resulting in the production of a creative output. Having a clear sense of purpose encourages participants to make the best of the time available, and acknowledge the importance of setting goals to drive their work.

**Cultural awareness and expression.** The British Museum offers learners the possibility to come into contact with historical representations and objects from diverse nations and cultures, expressed through different ways of thinking, celebrating, expressing and creating. Moreover, sessions invite learners to articulate a creative response: not only to absorb information about the cultures represented, but to engage with knowledge, relate to their own experience and construct meaning from their engagement, often expressed through the design of an artefact.

The degree to which these educational outcomes are attained has to be examined, however, in the right light, mindful of the fact that the SDDC learning experiences are one-off engagements. They are intense moments integrated in very diverse life and educational journeys. Whilst sessions have precise targets with respect to knowledge and skills to be cultivated, they are not aimed to build knowledge and skills in a definitive way. They are
orientated towards harnessing and strengthening existing knowledge and skills, providing basic coverage for new skills, and especially opening up perspectives and directions for learning, settling bases on which students and teachers can build further.

Engaging the lifelong learner

One of the most elusive yet significant impacts of the SDDC is the creation of a relationship or a connection with lifelong learners which can be enduring and rewarding beyond one or two visits with one’s family or school. By engaging in a learning experience perceived to be inspirational, creative, immersive and worthwhile, children are prone to develop a positive connection to the museum and likely to come back in later years. As a former Learning Programmes Manager remarks:

*Having a positive first experience at the museum establishes an absolutely crucial connection, it plants a crucial seed, which means that children are much more likely to establish a lifelong learning relationship with the museum as a place for learning. If they have been through a really enjoyable digital learning experience, then children who wouldn't ordinarily form a positive view of the museum develop a positive connection and therefore they are much more likely to go to a museum in the future. It sows the seed for them to see the museum as a place for them and as a source and a venue for informal learning, even when they become adults.* (Interview with former SDDC Learning Programmes Manager, 20/06/15).

For nurturing this connection, it is important to make participants feel comfortable in the museum premises and encourage them to “develop a sense of entitlement and a sense of ownership of the museum spaces so that they felt comfortable enough to come back at the museum at some point in the future saying ‘I know this place, this as much my place as it is the curator’s place, or the creative practitioner’s place. This is as much my space, my place, as a member of the community, as it is these adults’.” (Interview with former SDDC Learning Programmes Manager, 20/06/15).

Bridging informal, non-formal and formal learning

Schools are important audiences for the SDDC: The Centre receives around 10,000 combined family and school visitors every year. In the first four years of operation, it received around 5,000 students per year. Recently, the efforts to expand the outreach for school audiences raised this figure to 7,500 students reached in the academic year 2014/15. In the future the Centre is seeking to expand its school outreach further. Evaluations carried out with teachers throughout the years reveal a generally high and very high level of satisfaction with the sessions. In addition, the growing request for SDDC sessions by schools is in itself an indication of the satisfaction of the teachers and learners involved.

Activities bridge and complement formal education in several ways: Firstly, by cultivating content knowledge and skills as described above. For school audiences, in particular digital literacy skills are becoming increasingly important, as technology-related subjects are being added or expanded in curricula. Secondly, by committing to offer harmonious, engaging and satisfactory experiences for learners. These experiences carry with them the seeds that can be further exploited in future learning, whether for knowledge or skills building or following up on a passion that is discovered or ignited in the museum premises. Part of it is encouraging participants to come up with a creative response, a personal reaction and expressive output which indicates that the learning experience has left a trace in one’s memory:

*The creative response is about process and not about outcomes, not about the result, but also not necessarily about the content. Although this is technically supposed to be about the object or around the object, ultimately there has to be freedom within that. (...) And that has to be a legitimate learning outcome. (...) Equally if it is very difficult then to say that the way that*
they have engaged with the content may not come out in the creative response they do within those five days, this does not mean to imply that they might not come back to it at some point later in their lives. The fact that they have worked with content from the museum, they have worked with an object, and they have done it in the museum space, this is actually a really crucial point. (Interview with former SDDC Learning Programmes Manager, 20/06/15)

A memorable experience then provides a link, a trace which can be followed up, as an education facilitator remarks:

They will definitely think back to it. Some schools come in at the beginning of their topic, some will come in the middle, and some will come at the end. If they come at the beginning they would use this in so many ways. Because school trips are the things that hopefully excite the children more than anything, get them thinking differently, they are outside of their normal surrounding which I think instantly makes it more memorable. So I think we’ve got a really important job to make that topic or that area exciting for them. That they then can go off and learn a bit more either in class or independently as well. (Interview with SDDC Museum educator, 23/07/15)

Feedback volunteered by teachers who had attended SDDC sessions with their classes reveals that often learning experiences are continued in the classroom, especially by examining and showing the creative outputs produced by students during the sessions. In some cases artefacts are shared throughout the school, or even led to organising events where parents were called to view them.

Thirdly, an aspect to consider is the impact that such short engagements may have on teachers’ practice. For many teachers, the SDDC provides the opportunity to offer their students a learning experience that cannot be accommodated in school: the museum space itself and the richness of artefacts and stories, the technologies used, but also learning approaches that may not be used by teachers in their day to day teaching life. These experiences provide a flavour of effective learning that can be done differently from traditional education, and may impact on teachers’ practice in unexpected ways. SDDC managers are fully aware of the potential their sessions have on instilling innovative ways of thinking and teaching. A potential link to teachers’ practice is again represented by the last part of sessions with a creative component: after students groups finish their artefacts, two-three groups will have the occasion to show their work to the class. Even if it is just a small number of students whose work will be presented, this is a way to model the activity for the teacher. If willing, a teacher can follow up in class and use this model to create an occasion for sharing digital artefacts with the class and discussing upon them. The SDDC therefore provides unobtrusive but powerful ways for innovating teaching practice.

Cultivating innovation in informal learning

Within the British Museum, the SDDC was conceived in the first place as a venue for innovative learning, prone to come up with novel ways of providing access and engagement with museum collections. The driving engine for constant cultivation of innovation is the partnership between a cultural institution and a technology company\(^2\). One of the rewarding aspects of the partnership is that constant improvement, evolution, and experimentation are

\(^2\) The partnership between the British Museum and Samsung Electronic has been shortlisted for or awarded several awards:

- 35th annual Arts & Business Awards - Long Term Partnership Award (2014)
- Mobile Entertainment Awards – Best Augmented Reality Campaign (2014)
- UK Sponsorship Awards – Best Education and Learning Sponsorship (2015)
afforded by the provision of latest technologies. While as remarked above technology is not
the end point in designing and delivering learning experiences, all the achievements of the
Centre are possible due to the availability of technology, which provides the affordances
around which new content interaction patterns are designed.

The SDDC educational offer can be regarded as innovative from several angles:

- Design of learning experiences that offer elements of novelty in the way they combine
  participatory learning approaches with skilful integration of digital technology. An
  important aspect in here is how these sessions support different learning styles often
  not privileged in schools such as visual, social and kinaesthetic learning.
- The type of content knowledge and skill areas covered, which are defined and re-
  defined in a responsive way following societal trends, whilst often school curricula are
  lagging behind.
- New ways of interacting with content and new digital interaction styles. These are
  often afforded by using new technologies, from AR to 3D printing.

Innovation is spread starting with the participants involved in sessions, including school
audiences (teachers and learners), teens and families. As outlined above, a key point is the
contribution that SDDC experiences bring to innovating teachers’ practice. Moreover, the
SDDC puts through ideas, models, and formats which are inspiring for the broader community
of museum educators. At an even broader scale, the SDDC is one of the actors that
contribute to bridging the skills gap between the education and the job market, by offering the
possibility to build up skills asked for by latest social and economic trends and technological
advancement. Examples are the interest in organising big data sessions, or sessions on
making and crafts, or the emerging topics and technologies explored in the Innovation Labs.

7. Conclusion and considerations for practice

This report examined how a digital learning centre in a cultural history museum can contribute
to supporting lifelong learning. Whilst there is a widespread understanding of lifelong learning
as intimately connected, even focused on adult learning, this study adopted the view that
lifelong learning starts from pre-

- Giving basic training or honing a wide range of key competences for lifelong learning.
  Key competences are targeted related to digital literacy, communication, cultural
  awareness and expression, and social and collaborative skills among others. The
  sessions offered by SDDC are short experiential engagements where existing
  competences can be strengthened, or the foundations of new ones can be created.
- Creating the premises for a lifelong connection between the individual learner and
  museums. By providing engaging, satisfactory learning experiences, the Centre
  positions or re-positions the museum in the learner’s mind as a welcoming,
  comfortable and stimulating place for studying in a fun and engaging way. This
  creates an opening towards museums as places of learning, and inclinations to look
  out for or seize opportunities for museum learning throughout one’s lifetime.
- Linking with and complementing formal learning. Schools are an important audience
  for the SDDC. The centre reaches out to schools by offering activities that
  complement the curriculum, and bring as well an element of novelty: engaging with
  technologies that are not available or not integrated in school learning, or patterns of
  engagement that differ from traditional scholarly practices. Activities also stimulate
  and inspire teachers’ practice, by pointing to new pedagogical strategies or indicating
  ways of following up and expanding the impact of the short learning episodes.
• Stimulating and spreading innovation in informal learning. Innovation is related to the design of learning activities, which blend digital interaction in a learning framework configured by object-based learning and participatory learning elements. The subject areas and competences targeted are defined as well in response to social and technological trends, helping to bridge the gap between job market requirements and educational provision.

One of the most significant lessons offered by the SDDC is the way it configures its educational offer balancing requirements from three areas: 1) the social mission of the museum, maintaining a firm focus on the collection; 2) the needs, interests and profiles of diverse audiences; and 3) evolving trends in society and technology use, which result in requirements for new skills, or the configuration of new ways of digital engagement and interaction. Through attention to these areas, the Centre constantly revises and improves its educational offer, managing to keep ahead and aligned to societal trends without losing its commitment to the museum mission and audience engagement strategy.

Responsiveness is made possible by the design approach adopted by the SDDC, which leaves space for experimentation, and is a fertile ground for cultivating innovation. The starting point for trying out new sessions can be found in a new technology (e.g. AR technology), a new learning outcome (e.g. digital animation or 3D printing skills), responding to a societal trend in either education or technology use (e.g. big data) or be driven by changes to the national curriculum in the case of school programmes. The swift approach to design, inspired by Lean and Agile methodologies, means that new types of sessions can be tried out, iterated a few times and further improved and integrated in the regular programme, or dropped, depending on the response or the evolution of the SDDC plans. For example, over the years, the integration of new technologies provided occasions for changing modalities of engagement or designing altogether new sessions. When Samsung delivered Galaxy tablets for the Centre, activities that previously used laptops were re-designed around tablet interaction modalities. Experiments were made as well with new technologies such as AR, 3D animation, 3D printing, etc. Some of these were tried out in one-off programmes or sessions (e.g., the AR project Cultures in contact delivered in 2011, in collaboration with the British Museum’s Learning department), or offered in conjunction with temporary exhibitions (e.g., the mobile app for students designed in-house for the exhibition Hajj: Journey to the heart of Islam); others became part of the broader educational offer (e.g., the AR app A gift for Athena was designed and developed in cooperation with the company Gamar to experiment with AR technology, and then maintained in the programme for schools).

References


