A Proposed Framework for Developing Online Courses: The case for a VR Course.

A Research Design for an Empirical Research Paper presented to
The Department of Information Systems
University of Cape Town

By

Norman van Wyk

VWYNOR002

in partial fulfillment of the requirements of the BCOM(HONS) Information Systems Course

25 September 2019

TABLE OF CONTENTS

ABSTRACT

Online learning has become a standard in today's teaching environment whether teaching fully online or using a blended learning approach. Various kinds of emerging technologies such as Virtual Reality are continually evolving or being developed, and educators are required to keep up with this trend. Educators are required to create and teach courses that not only informs and educates, but also motivates the learner to complete the courses. The traditional educator is often asked to develop an online course with perhaps no experience or guide to do so.

The main research question this study attempted to answer was if an Online Course Development Framework could be created that can aid educators in developing online courses for emerging technologies. This research study set out to discover if there are any theories, methods and models that can support educators to develop online courses for emerging technologies and then, to develop a framework that can be used to aid educators in developing online courses. To achieve the findings of the main research question, the research conducted a literature review to discover theories models and methods that could be used in the creation of an online course, then conducting semi-structured interviews with expert educators. The semi-structured interviews were then analysed using a thematic analysis process. An Online Course Development Framework was then created based on literature review findings and interview responses. Thereafter, the framework was tested by gathering feedback from experienced educators after presenting the Online Course Development Framework and an Online Virtual Reality Development course outline that was created by using the framework. The research found that by combining a learning theory such as constructivism, the ADDIE Instructional design model, ARCS-V Motivational model, and Bloom's Taxonomy to construct the framework, the Online Course Development Framework could be used to support educators in creating online courses for emerging technologies.

When tested, the Online Course Development Framework proved to be relevant to the expert educators that responded to requests for feedback. All the educators thought that it could be used to help support the development of online courses for emerging technologies and provided an all-important motivational design element that is needed in online courses. By providing a useful online course development framework, educators could develop more online courses for emerging technologies.

KEY WORDS

Online Learning, Course Development, Framework, Emerging Technology, Virtual Reality.

1 INTRODUCTION

The current generation of learners expect exciting and engaging activities with diverse instructional styles but unfortunately, the educational field has generally been slow to adopt changes in learning approaches (Arghode, Brieger, & McLean, 2017). With new technologies continually evolving and more courses required to be taught online, educators are under pressure to deliver on the promise of online education (Horvitz, Beach, Anderson, & Xia, 2015). Consequently,

developing online courses presents challenges for educators that are different from developing classroom-based face-to-face courses. Researchers have stressed the need for diverse didactic principles for online learning, online instruction design and learning philosophies (Arghode et al., 2017). For this reason, there is a current need for a framework that could guide educators to develop online courses, especially courses in emerging technologies (Panetta, 2018).

With the aforementioned in mind, a prominent example in emerging technologies is Virtual Reality (VR). VR can best be described as a technology that is used to create virtual 3-dimensional experiences in which users experience an immersive, artificial environment using the user's sensory perception and physical movement (Ludlow, 2017). It is estimated by 2020, that 70% of businesses and institutions will be utilising immersive technologies such as VR for a wide variety of uses (Panetta, 2018). This in turn will lead to new immersive virtual experiences and consequently, alter how users use this technology (Panetta, 2018). Regarding the availability of VR, cheaper and easily accessible VR devices such as the Oculus Quest, have been available since June 2019 (Facebook Technologies LLC, 2019). Educators are more than likely be required to develop courses for emerging technologies such as VR and with many learners using online learning as a preferred method to learn, the need for online courses will only continue to rise (Panetta, 2018).

From a general institutional perspective, developing an online course requires the educator to consider not only the content required, but also a multitude of additional factors across a range of disciplines (McCaffrey, 2017). For example, to develop an online VR course, one would need to consider the VR content itself, as mentioned by Obrist and Martinez (2015), as well as possibly utilising a framework to build the course. For this reason, the primary aim of this empirical research study was to create a general-purpose Online Course Development Framework that could aid educators in developing emerging technology courses. Within the scope of this research study, VR is used as a test case for developing an online course for an emerging technology. Furthermore, this framework could also be used for developing online courses on topics such as Augmented Reality, Mixed Reality, Internet of Things etc.

In order to commence this research study, firstly, a review of the literature was conducted in order to establish the research questions. Secondly, it was essential to identify an appropriate research methodology in line with the research questions. Thirdly, data was gathered and analysed regarding the fundamentals of an Online Course Development Framework. Lastly, after completion of the analysis, the Online Course Development Framework was developed, and a proof of concept presented. This was done by creating a course outline using an emerging technology, VR, as an example.

1.1 Purpose of Research

This research study aimed at developing a general-purpose Online Course Development Framework that educators can use to create emerging and current technology courses for online delivery. This research study gathered information regarding learning theories, design methods and models applied in the online education space, to build upon and produce a general-purpose Online Course Development Framework (OCDF).

To verify the framework, experts in the online education arena were interviewed using a semi-structured approach. The interview responses were analysed using a qualitative content analysis approach by coding the data and verifying the

functional effectiveness of the proposed framework. By creating and verifying a general-purpose OCDF, the research aimed to encourage and facilitate educators to develop online courses and content, especially in emerging technologies.

After the framework was established, the framework was used in the creation of an Online Virtual Reality Development (OVRD) course outline, as a test case.

1.2 Research Questions

Main Research Question:

a.) RQ1: ***Could an Online Course Development Framework be created that could aid educators in developing online courses for emerging technologies?***

Sub Research Questions:

b.) RQ1.1: Which learning theories could be used to construct a useful framework for developing online courses?

This research study evaluated learning theories that could be useful in developing a framework for creating online courses. The research did not cater for classroom-based courses. Therefore, the learning theories discussed is for supporting online course development only.

c.) RQ1.2: Could any of these theories be used to develop courses in emerging technologies such as an Online Virtual Reality Development course?

The research evaluated different learning theories to discover which learning theories are suitable for an emerging technologies course such as an Online Virtual Reality course. This research evaluated learning theories specifically to cater for emerging technologies. Whether or not the learning theories discussed could be used in other types of course development is merely a factor of the learning theory and not specifically discussed or intended.

d.) RQ1.3: What methods or models could be used to construct a framework for the development of online courses?

The research evaluated prior research conducted in online teaching and learning to discover pedagogical models and methods applied in developing online courses. The methods that were a good fit for the framework were discussed. Thus, non-relevant or otherwise models or methods not found were not discussed in the literature review.

e.) ***RQ1.4:*** **How can the framework be used to develop a course for emerging technologies such as an Online Virtual Reality Development course?**

The research then evaluated the requirements for a course in developing Virtual Reality applications, exploring the implementations of hardware and software as well as the benefits and challenges of Virtual Reality development. The findings were used to establish the reasoning and basis for developing an Online Virtual Reality Development course outline by using the Online Course Development Framework to develop it. The framework developed was tested with one test course outline. Therefore, the scope could be limited or vast, but the findings with regards to scope will have to be evaluated with a longer cross sectional or longitudinal study.

1.2.1 *Research Assumptions and Ethics*

The research study assumed the following:

The findings based on previous research as discovered in the literature review were assumed to be of good standing and findings appropriate for the field of study.

Furthermore, the research made contact with educators who are seen as experts in the field of education due to the nature of work, experience and/or positions of the research respondents.

Ethical concerns:

There were concerns over personal and organisational information of the respondents being obtained and kept. To address this concern, ethically all attempts were made to not discuss any identifiable information of the respondents in this study. Ethics approval was obtained before conducting this research study. Respondents were not contacted to participated in this study before ethics clearance were obtained.

2 LITERATURE REVIEW

The literature review followed a systematic literature review process taken from Brereton, Kitchenham, Budgen, Turner, and Khalil (2007), that followed the stages of planning the literature review, conducting the a literature review and finally validating the literature review.

In conducting the literature review, the review mainly made use of Google Scholar and the Educational Resources Information Center (ERIC) restricted to peer-reviewed journals to search for relevant literature (Noruzi, 2016). Only papers published in English were included, all other languages were excluded. Furthermore, the search results predominantly focused on results from the last five years, 2015-2019. Published and peer-reviewed journals were primarily used, and where necessary, books and relevant websites were cited. Older references were used where appropriate to describe research based on prior research and findings such as Keller (2010). The literature review discusses learning theories,

Instructional design methods, and motivational design models that could be used to develop an Online Course Development Framework (OCDF).

2.1 Educator support

Research suggests that educators could benefit from research and support in the form of best practices in instructional design and student learning with regards to online courses, especially new online educators (Horvitz et al., 2015). Furthermore, studies indicate that research based on focusing on students, best practices as well as student interactions would be welcome additions in the instructional practices, especially if they are easy to apply (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017).

2.2 How do learners learn?

In the twenty-first century the way educators address learning depends a lot on their experience but additionally and perhaps more importantly, they will need to have a shift in perspective of learning as this type of learning is different from the learning in the more structured learning environments of the classroom (Yilmaz & Cagiltay, 2016). The question of how learning takes place in a human being is the fundamental questions in instruction and teaching (Illeris, 2018). Developed from learning psychology with additional influences such as pedagogical, sociological and medical research mainly in the form of cognitive and brain research has led to the development of learning theories (Illeris, 2018).

2.3 Learning theories

The literature review discussed learning theories and models that could be used to develop an Online Course Development Framework (OCDF) for emerging technologies. Learning theory is a vast subject that has many different aspects such as neuroscience, psychology, and education (Juvova, Chudy, Neumeister, Plischke, & Kvintova, 2015). Fundamental learning theories that exist, that are used within a broad spectrum of online course material are cognitivism, connectivism, behaviourism and constructivism as shown in Figure 1.

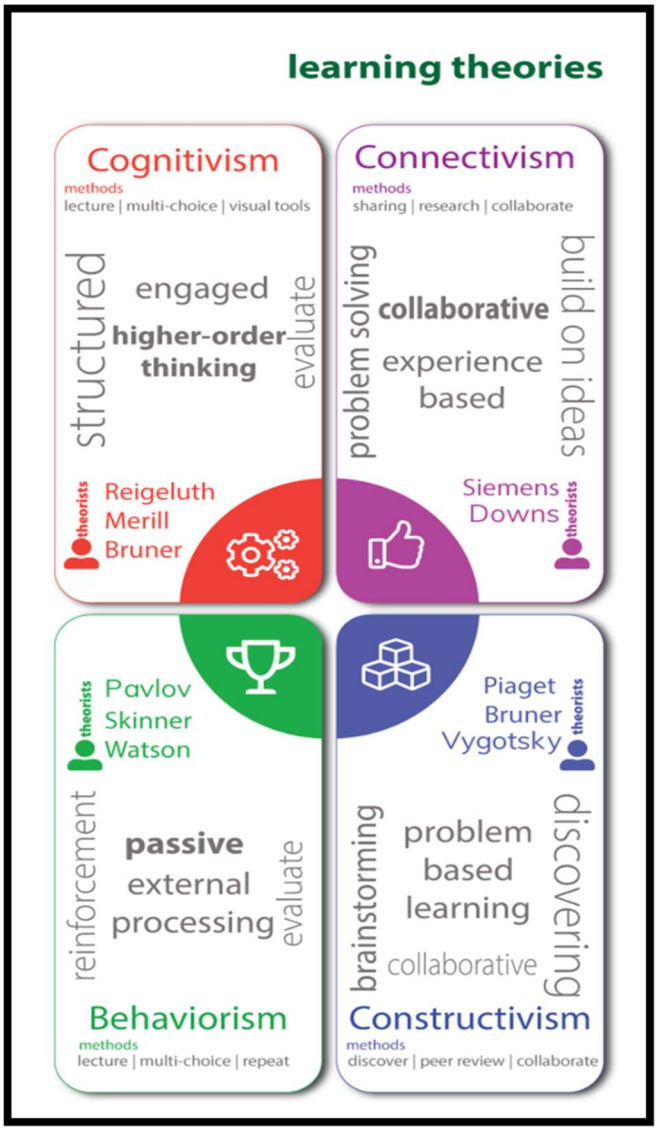


FIGURE 1. POPULAR LEARNING THEORIES **(Davis, 2019).**

The literature review identified leaning theories that could be used in the development of an OCDF by looking at key elements of the learning theories that would prove useful for a course delivered online.

Learning theories outline how a student learns and acquires knowledge, retains the knowledge and recalls the knowledge by describing some general principles (Do, 2018). Reflecting on the studies regarding learning theories, the paper by Arghode, Brieger, and McLean (2017) states "Learning theories deserve more attention in an online learning environment. The study of learning theories combined with an in-depth analysis of psychological and human resource literature will enable researchers to delve deeply into the subject. More qualitative studies are needed to explore further how an instructor's ability to utilize theoretical principles to improve instruction can make a difference in learning" (p. 604).

This led to the research question **RQ1.1:** ***Which learning theories could be used to construct a useful framework for developing online courses?***

The learning theories evaluated were:

- Behaviourism
- Cognitivism
- Connectivism
- Constructivism

2.3.1 *Behaviourism*

The behaviourism theory concentrates on measurable and observable behaviour or actions and on the importance of the consequences that follow the behavior or action (Saari, 2019). Behaviourism evolved from a positivist worldview related to cause and effect. Behaviourism ignores that which cannot be observed, thus it ignores the internal knowledge, previous knowledge or mental process in determining the knowledge (Yarbrough, 2018). In education, behaviourism examines how students behave while learning. More specifically, behaviourism focuses on observing how students respond to certain stimuli that, when repeated, can be evaluated, quantified, and eventually controlled for each individual (Yarbrough, 2018). Consequently, the behaviourism theory establishes the theory as an idea that the learning behavior can be controlled by establishing consequences that will guide the behavior of the learner by providing negative or positive feedback as a response (Saari, 2019). The learning can then only be successful when students connect required responses with desired outcomes through conditioning (Arghode et al., 2017).

The behaviourism theory has established a very rigid and structured approach (Meier, 2016; Yarbrough, 2018). The idea is that by rewarding correct responses to solving a problem or answering a question correctly and punishing an incorrect answer by giving a negative response, the student would learn the correct behavior. Behaviourism does not take into account the mental processing by the learners but instead focuses solely on observable behavior (Robinson, 2018). Behaviourism teaches by enforcement and reinforcement of pre-conceived and designed outcomes (Saari, 2019). Behaviourism theory is often used in linguistic learning programs and training of animals (Meier, 2016; Saari, 2019).

Behaviourism started to show limitations when it could not explain many social behaviours, and this limitation gave rise to the Cognitivism theory (Harasim, 2017). Behaviourism could be used where the learning material could be developed so that it emphasizes a response conditioning approach.

Behaviourism theory could be appropriate when designing online courses as it encourages the development of:

1.) Measurable and observable learning outcomes (Yan, 2017).
2.) Using rewards and feedback to improve performance (Arghode et al., 2017).
3.) To guide students to master predictable skills (Arghode et al., 2017)

2.3.2 *Cognitivism*

The limitations in the behaviourist theory gave rise to the cognitivism theory. The cognitivist theory argues that instead of direct input to output that does not consider internal factors, there are other influences in how the learner stores, processes and retrieves data such as remembering, thinking and reflecting (Khalil & Elkhider, 2016). Cognitivism focuses on the inner mind of students and as such focuses inward and looks at how the learners' minds make sense of the knowledge acquired. The cognitivist theory argues that instead of direct input to output that does not consider internal factors, there are other influences in how the learner stores, processes and retrieves data such as remembering, thinking and reflecting (Khalil & Elkhider, 2016). Within cognitivism, learning instruction is designed to engage and promote participation so that the student is actively involved in the development of goals and activities (Arghode et al., 2017). While connectivism connects nodes of information in the learning process, it goes further to emphasize that the capacity of knowing is more important than what is currently known (Veletsianos, 2016). By connecting a set of nodes of diverse opinions, knowledge, data, and meaning, continued learning is promoted. Thus, connectivism lends itself well to online learning where a learner can keep on learning no matter where they are based (Veletsianos, 2016). Connectivism interestingly also adds that learning can happen between non-human instances, for example, in artificial intelligence uses (Reese, 2015). While connectivism fits well with modern day technological advancements to learning, it relinquishes control of the educator to a wealth of information that is dispersed and unstructured. While this is good for general information and building on previous knowledge, connectivism theory has the risk of adding information that is not relevant without guidance and some form of control.

Cognitivism has some aspects that would be suitable for an online course framework such as:

1.) The promotion of participation (Khalil & Elkhider, 2016).
2.) Reflective thinking (Khalil & Elkhider, 2016)
3.) Mapping of concepts (Arghode et al., 2017).

2.3.3 *Connectivism*

The connectivism theory is described as learning in the information or digital age where learning knowledge is distributed across networks where connections and connectedness inform learning, based on the future not the past(Kizito, 2016). Students find meaning and make connections between data, ideas, and concepts as a crucial part of the learning experience (Reese, 2015). The clustering (gathering of information) of the nodes allows the students to share ideas, interact and experience learning together (Goldie, 2016). Technological advancements have occurred rapidly and traditional learning theories like behaviourism, have struggled to keep up with emerging technologies (Yumurtaci, 2017). Connectivism aims to bring together the networked nature of society into the learning constructs. Other than theories such as behaviourism and cognitivism, which places learning as a separate inner construction of knowledge, connectivism emphasizes the importance of how and where to access information instead (Goldie, 2016). Learning can be set outside of students, as opposed to an internalized set of knowledge as it is with cognitivism and constructivism. Moreover, the connectivism theory takes the stance that the information that exists would be too much for one person to be able to make sense of and is treated as internalized knowledge even though it is coming from external nodes (Goldie, 2016). While connectivism fits exceptionally well with modern technological advancements to learning, it relinquishes control of the educator to a wealth

of information that is dispersed and unstructured (Reese, 2015). Connectivism would be beneficial to an online course where:

1.) Learning is collected in the diversity of opinions (Reese, 2015).
2.) Social collaboration is of high importance (Bair & Stafford, 2016).
3.) Decision making itself is a process (Reese, 2015).

2.3.4 *Constructivism*

Constructivism as a theory suggests that learning is a learner focused constructive process and that students create and construct their own reality of learning using prior knowledge in constructing new knowledge (Jiang, 2019). The premise stated by constructivism emphasizes the active role that learners themselves play in constructing knowledge and inspires them to construct meaning from what they have seen, heard, did and experienced. (Arghode et al., 2017). Forming the constructs are based on prior knowledge as well as constructing knowledge from others, and this leads the learning and knowledge formulation to be subjective in nature (Harasim, 2017). Thus, learners demonstrate understanding not just by repeating information but from demonstrating theoretical knowledge. (Juvova et al., 2015). In other words, the learner makes sense of their world by experiencing the learning and then constructing meaning (Johnston, Olivas, Steele, Smith, & Bailey, 2018). Constructivism promotes a learner centred theory where experimentation and active participation is encouraged so that the learner can create more new knowledge and reflect on what was learned. By building on previous experience and knowledge, new learning can take place from a shared understanding between student and educator (Bada, 2015). Furthermore, constructivists state that the process of 'how' a student learned is as important as the 'what' that was learned (Bada, 2015). Of further importance is that constructivism promotes social interaction between students in order to solve issues by working together. In the teaching environment, constructivism may be helpful where complex skills such as critical thinking and problem-solving must be grasped. The role of the teacher is set as a participant who encourages interactivity and helps the learner construct knowledge (Arghode et al., 2017; Hood Cattaneo, 2017; Usher, Edwards, & de Meyrick, 2015). Critics of constructivism points out that constructivism is a reiterative process that re-examines problems continually (Tan, 2017). Furthermore, the argument is made that there is no emphasis on correct answers to problems, but a focus on the interpretation of the students' constructs (Tan, 2017). Proponents, however, argue that by engaging the learner by building on their experience, it promotes testing of knowledge in a meaningful manner (Bada, 2015). The research by Usher et al. (2015) suggests that by interacting socially, the learning senses are heightened when working together and therefore has a positive effect on learning. Constructivist learning theory should be implemented with a suitable design method of motivating the student to encourage their willingness to participate and find meaning in the content. Cognitive and social presence are part of the constructivism view of shaping online learning using interaction, collaboration, and dialogue (Scoppio & Luyt, 2017). Constructivism is considered one of the leading learning theories in education (Amineh & Asl, 2015).

Constructivism theory could be appropriate when developing online courses where:

1.) The learner is in control of their learning (Usher et al., 2015).
2.) Group learning is encouraged (Amineh & Asl, 2015).
3.) The process of knowledge construction is important (Tan, 2017).
4.) Tutoring and apprentice roles are required (Amineh & Asl, 2015).

5.) Problem-based learning and brainstorming are implemented (Khalil & Elkhider, 2016).

This led to the research question **RQ1.2:** ***Could any of these theories be used for an Online Virtual Reality Development course?***

2.4 Instructional Strategy Of Online Course Development

Online teaching and learning have become commonplace and is widely accepted as an alternative to, and in addition to classroom-based courses (Kumi-Yeboah, 2018). Online learning has become an inherent part of many institutions' strategy and forms an essential facet in their plans (Kumi-Yeboah, 2018).

As the growth of online course delivery has expanded there has been an increased drive towards quality instructional design methods and the quality of the course material developed (Kumi-Yeboah, 2018). As a result, while technology evolves and more learners are considering online learning as an alternative study path, it is essential to further develop frameworks to develop online courses (Dumford & Miller, 2018). Scoppio and Luyt (2017) also stated that using connectivism and constructivism paradigms as theories to develop instructionally comprehensive learning could be beneficial to the course designer so as to develop online courses, and therefore would be suitable for an online course framework.

Classroom teachers and instructors are recruited to help develop content for online delivery (Baldwin & Ching, 2019). Since most teachers have valuable experience in creating classroom-based courses, the fact that it requires a specific pedagogical approach to develop online courses are often not considered when they make the transition from classroom-based models of teaching to online based models (Scoppio & Luyt, 2017). Learning and perception can change depending on the technological situation (Scoppio & Luyt, 2017). When classroom teachers are expected to teach online courses it has resulted in physical and conceptual gaps in communication and misunderstandings between teacher and student as Scoppio and Luyt (2017) discussed. The instructional model plays an significant role in the teaching design and learning process (Hess & Greer, 2016)

The purpose of an instructional design model is to support learning designers and teachers to ensure that their teaching material and content is aligned in an optimum manner to aid the students learning development (Cheung, 2016). Instructional Design is the principles and procedures that applies to the consistent and reliable development of instructional material, content, information sources, lessons and whole learning systems (Kathryn, Hess, & Greer, 2016). Instructional Design is an system based approach that follows guidelines, procedures and models as well as allow for evaluation of the educational design process (Kathryn et al., 2016). An effective instructional design model is the ADDIE instructional design model (Alnajdi, 2018).

2.5 The ADDIE Instructional Design Model

The ADDIE instructional design model consists of five categories namely, Analysis, Design, Development, Implementation, Evaluation (Budoya, Kissake, & Mtebe, 2019). The ADDIE model is widely used in the instructional design and development field and often described as being instrumental to the improvement of teaching and learning (Cheung, 2016; Kathryn et al., 2016). ADDIE continues to be one of the most popular and widely used models for instructional design (Abdul Ghani & Wan Daud, 2018). It is used as the blueprint to design applicable instruction and aids in providing methods for continues evaluation and analysis of the content (Hess & Greer, 2016). However, as described earlier by Hattie (2015), all learning design models have some form of improvement but that the specific model of design chosen, might not be the optimal way of delivering that particular learning content.

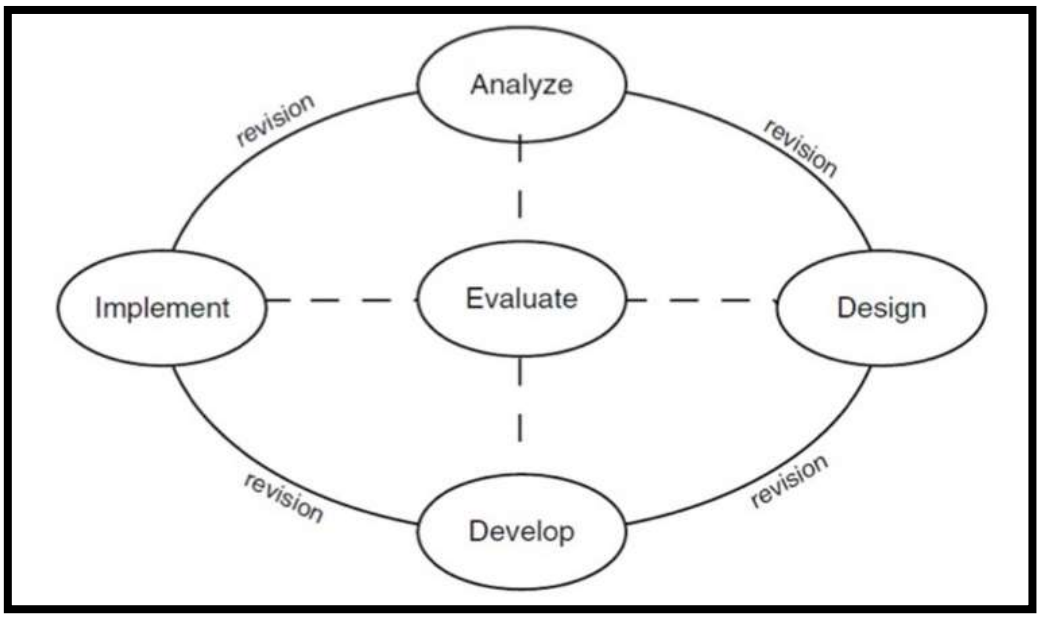


Figure 2. *ADDIE Instructional design model* (Alnajdi, 2018).

The different steps of the ADDIE instructional design model are used as follows:

Analysis: In the analysis step the educator analyses the needs of the learners by looking at the educational objectives if the course and designing the outcomes to align to the educational goals (Cheung, 2016). Some of the topics that need to be analysed could be how long a course should be or what evaluation criteria needs to take place (Trust & Pektas, 2018).

Design: In the design step, educators need to develop the learning activities, assessment, and methods of delivery. In addition they should develop the strategies on how to present the course material (Hess & Greer, 2016; Trust & Pektas, 2018).

Development: In the development step the course creators develop the content assets and put all the materials together from the design of the design step. Project review and fixes or changes are implemented and iterated upon, until the

development of the course content is complete (Cheung, 2016). The reviews and iteration can be based on feedback from pilot studies or test participants (Hess & Greer, 2016).

Implementation: Implementation is the next step in the ADDIE model. This step requires the designed course to be launched or delivered. In this step it is crucial to be aware of feedback from learners should there be any unforeseen issues in the delivery (Cheung, 2016).

Evaluation: In the final evaluation step the response from feedback and general usage of the course must be taken into consideration. These responses would then be used to re-analyse the course for a new design or to fix issues (Cheung, 2016).

Even though the ADDIE model has been used in a vast number of instructional developments the model shows some disadvantages (Alnajdi, 2018; Jung, Kim, & Lee, 2018; Nadiyah & Faaizah, 2015). Although the ADDIE model focuses on systematic design procedures, the model has received criticism for being too inflexible and linear in nature, often being too drawn out and time-consuming for modern fast-paced online learning (Jung et al., 2018). However, by applying some Agile methods to the ADDIE model it is suggested that these limitations can be overcome. Research done in improving ADDIE for multimedia and software development instruction found that adding a Feature Driven Development Process (FDDP) to the ADDIE model suitably addressed the limitations (Christian Misobi Budoya, Mussa M. Kissaka, 2019).Furthermore, research conducted into extending ADDIE to include a course piloting step (X_ADDIE) has also been proposed (Constancio et al., 2018).

By using ADDIE in the instructional design process, it aids in keeping the complexities of learning design and instructional design at bay and increase the impact of the learning. A further benefit of using the ADDIE instructional design model is that different learning methods can be applied to establish knowledge acquisition by students of different learning styles (Alnajdi, 2018).

2.6 ARCS / ARCS-V motivational design model

Motivation can be thought of as the learner's inclination to participate and engage in the learning, through cognitive, emotional and practical application usually in an independent way, through difficulties and disappointments (Du Boulay & Del Soldato, 2016). Motivation can come from various fields and can even be linked to family background, parents and educators (Liu & Chiang, 2019). Motivation in learners is a key principle that drives learning, but in order to keep learners motivated it takes more than adding new technology to the online classroom. Using new technology helps, but when the novelty has worn off, educators need to have implemented instructional effective design and motivationally sound learning theories and models to keep the motivation level of the learner high (P. Libao et al., 2016). Keeping a learner motivated is a key factor in developing a successful instructional content (Khan, Johnston, & Ophoff, 2019). Whether online or face-to-face learning is taking place, positive learning cannot occur without the learner's efforts and willingness to learn and apply the concepts presented in the learning material. At the core, effective instructional practices should be accompanied by a sound motivated learner in order to promote learning (Arghode et al., 2017).

Each new technology application is accompanied by a predictable wave of publications describing its benefits and applications. However, the novelty effect associated with each of these innovations soon fades, leaving researchers with the continuing problems of providing learning experiences that are motivating to the learners and are instructionally effective (Keller, 2016). Certainly, adaptations of basic knowledge of motivation and learning have to be made by following the specific characteristics of a given technology or delivery system, but there are fundamental principles of motivation and learning that transcend these differences (Keller, 2016). Motivating and focusing on learning keys skills is an important part of building a functional and useful framework, and it begins with a discussion of issues related to technology and motivation.

The ARCS motivational model states that, "in order to motivate students, the instructor or instructional materials need to (1) catch and sustain students' attention; (2) state why the students need to learn the content; (3) make students believe that they are able to succeed if they exert effort; and (4) help students feel a sense of reward and pride. The ARCS model utilizes a systematic process which can be specified into four steps: define, design, develop, and evaluate" (Li & Keller, 2018, p.54).

The ARCS model presents a systematic design model to assist educators in creating course material and content with motivational elements for the learners (Keller, 2010, 2016; Loorbach, Peters, Karreman, & Steehouder, 2015). Intrinsic motivation creates a learner who is committed to learning the subject matter. The intrinsically motivated learner enjoys exploring and mastering the content and is more committed to do so (Keller, 2016; Khan et al., 2019; Ucar, 2016). The ARCS model was based on previous research on human motivation. It is shown that intrinsic motivation increases learning engagement and improves academic performance or learners (P. Libao et al., 2016).

Categories	Instructor's Self-Analysis	Instructor's Analysis of Learners
Attention	Am I excited about this learning experience and how I can make it interesting?	Are the learners going to be interested? What tactics will stimulate their curiosity and interest?
Relevance	Do I believe that this learning experience will be valuable for my learners?	Will learners believe it is valuable? What can I do to help them believe it is important?
Confidence	Am I confident in my ability to lead this learning experience effectively and interestingly?	Will the learners feel confident about their ability to learn this? What do I need to do to help them be confident?
Satisfaction	Do I expect to have positive feelings about this learning experience?	What can I do to help the learners feel good about their experience and desire to continue learning?
Volition	Will I provide effective supervision and support to the learners throughout this learning event?	What can I do to help the learners maintain their goal orientation and task-focus throughout this learning event?

Figure 3. *Creation aid for motivational strategy design* (Keller, 2016).

Keller first presented the ARCS model as a way to put the motivation of the student at the centre of the teaching and learning design (Chu, 2017). ARCS place motivation of the learner at the centre of the learning model in its entirety,

meaning the motivational aspect continues through each step of the model. In time ARCS proved problematic in one aspect - the research showed that it did not account for learner persistence (Keller, 2016). Keller (2016) explains that some learners persisted in their learning and completed the studies even when motivation faded, while others would give up even though the end results were essential to them. To account for these differences in motivation a fifth category was added to the ARCS model, called Volition, see Table 1, creating the ARCS-V model (Keller, 2016).

Table 1. Adapted ARCS to ARCS-V table.

Attention	Relevance	Confidence	Satisfaction	Volition
A1 Perceptual arousal	R1 Goal orientation	C1 Learning requirements	S1 Intrinsic reinforcement	V1 Commitment to learning
A2 Inquiry arousal	R2 Motive matching	C2 Success opportunities	S2 Extrinsic rewards	V2 Perseverance
A3 Variability	R3 Familiarity	C3 Personal control	S3 Equity	V3 Willpower

Note*: J. Keller (personal communication, May 6, 2019) agreed that the ARCS model table could be updated to show ARCS-V model in table.*

By using the constructivism theory as a guiding theory an applying the ARCS-V systematic design model to the design of the framework a motivationally effective course outline can be developed that keeps attention, relevance, confidence, satisfaction and volition as guiding principles.

2.7 Bloom's Taxonomy

Bloom's taxonomy fundamentally organises thinking skills into six hierarchical organized categories that go from lower zones of thinking complexity through to higher zones of thinking complexity. The hierarchies are constructed from the verbs the educator choose when describing expectations for thinking skills and behavior in a learning outcome (Stanny, 2016). The lower complexity thinking zones attempt to establish a basis for the 'knowing' and 'understanding' aspects of cognitive skills, whilst the higher complexity cognitive thinking zones establishes the basis of 'applying ', 'analysing', 'evaluating' and 'creating' (Stanny, 2016).

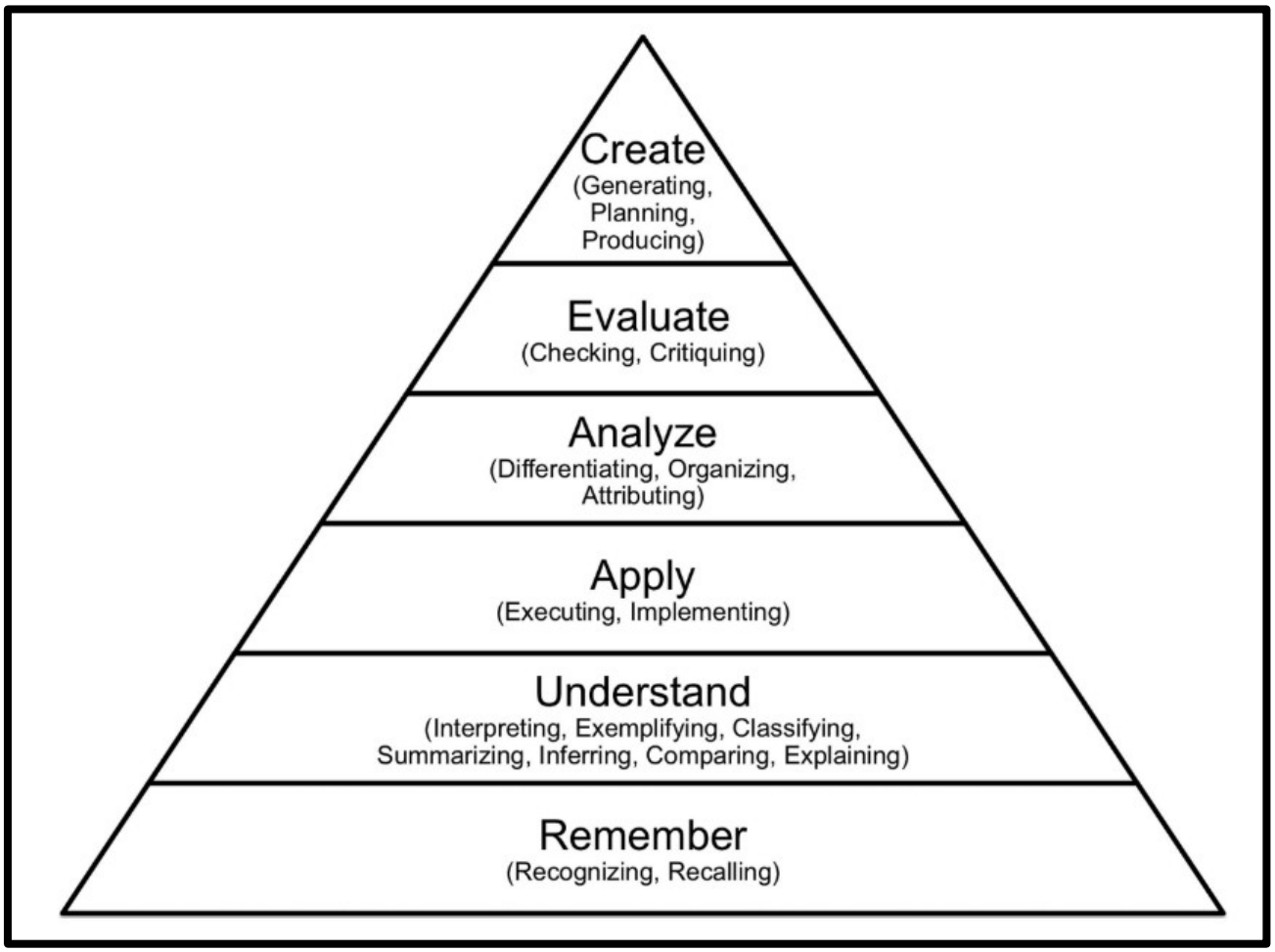


Figure 4. *Bloom's Taxonomy* (Agarwal, 2019)

The guiding principle built around Bloom's taxonomy assumes the keyword verbs in each category describe a progressive advancement of thinking skills. Thus, keyword verbs at the lower zones of Bloom's taxonomy defines knowledge acquisition and fact memorization, in contrast the higher zones defines more complex thinking skills such as applying the knowledge gained in lower zones to practical problems, analysing concepts and the creation of new knowledge or different interpretations of existing knowledge (Rahman & Manaf, 2017; Stanny, 2016). Thus, by building learning activities based on these different levels of thinking skills the progression from fundamental understanding to eventually creating new knowledge can be accomplished (Agarwal, 2019).

This research led to the research question ***RQ1.3: What methods or models could be used to construct a framework for the development of online courses?***

2.8 Course Framework Test Case

To test the Online Course Development Framework (OCDF), an Online Virtual Reality Development course was chosen as a test case. Evaluating aspects and requirements regarding Virtual Reality (VR) and VR development needed to be established before being able to apply the OCDF to the Online VR Development course outline.

2.8.1 *Emergent technologies: The Virtual Reality course outline*

Virtual Reality (VR) describes an interactive three-dimensional environment that enables users to navigate through an artificial environment using a VR headset or head-mounted display (HMD) (Noble, 2018; Obrist & Martinez, 2015). There is no reality, as all the content is computer-generated, and the user is isolated from the real world enabling an immersive experience (Noble, 2019).

An immersive experience is how people perceive and interact with the digital world using technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) (Cardoza, 2018; Panetta, 2018). This combined shift in both interaction and perception models lead to future immersive user experiences. "The model will shift from one of technology-literate people to one of people-literate technology" (Cearley & Burke, 2018, p. 23) Extended reality (XR) is an umbrella term that encompasses VR, AR and MR (Noble, 2019).

Virtual Reality is growing at a phenomenal rate and may catch educators and developers off-guard when more cost effective and easier to use devices launch. Businesses and institutions will be using immersive technologies such as VR for a wide variety of uses, which will lead to new immersive virtual experiences, changing how users use the technology (Panetta, 2018). Being able to deliver VR experiences and be able to take advantage of the technology will benefit companies greatly (Costello, 2019). However, developing content for Virtual Reality requires the developer to consider a multitude of factors and have skills across a wide range of disciplines, to master the development process (McCaffrey, 2017). Cheaper and easier access to VR devices such as the Oculus Quest are now available (Facebook Technologies LLC, 2019). Predictions suggest that organisations that exploit emerging technologies rapidly and in the most creative ways, will gain a competitive advantage (Costello, 2019). For this reason, it is imperative to consider emerging technologies such as VR for businesses and educational institutions.

Educators providing educational services could make use of a framework as a guide to develop online courses aimed at students interested in entering this growing market. This study provides such a proposed framework and uses an Online Virtual Reality Development (OVRD) course outline, as a test case.

Looking at the literature regarding Virtual Reality led to the research question ***RQ1.4: How can the framework be used to develop an emerging technologies course such as an Online Virtual Reality Development course?***

2.9 Conclusion of Literature Review

The combined findings in the literature review and sub questions led to the formulation and conclusion of forming the Main research question.

RQ1: ***Could an Online Course Development Framework be created that could aid educators in developing an online course for emerging technologies?***

Sub questions findings and conclusions from the literature review:

RQ1.1: Which learning theories could be used to construct a useful framework for developing online courses?
RQ1.2: Could any of these theories be used for an Online Virtual Reality Development course?

Through the literature review, it was found that it is essential to consider what the subject of learning is in order to establish the correct learning theory for the development of courses (Arghode et al., 2017; Dumford & Miller, 2018; McIver, Fitzsimmons, & Flanagan, 2016). By creating a framework for developing online courses for emergent technologies, the subject for testing the framework in this study will be an Online Virtual Reality Development course. In the literature review process, it was found that an online framework could be created using many of the learning theories such as cognitivism or connectivism (Arghode et al., 2017; Do, 2018; Tan, 2017). However, developing an Online Course Development Framework and using it for developing an Online Virtual Reality Development course outline, the constructivist theory is most suitable since it allows for new knowledge construction from past knowledge, learner centred approach and setting the educator as a participant that encourages interactivity (Arghode et al., 2017; Bada, 2015; Scoppio & Luyt, 2017). After evaluating other possible learning theories, the constructivist learning theory stood out as a correct theory be chosen to specifically enhance the online course development framework especially in regard to current and emerging technologies such as VR.

RQ1.3: What methods or models could be used to construct a framework for the development of online courses?

The ADDIE model was chosen as an Instructional Design model, combined with Bloom's taxonomy as a guiding model for the framework with regards to evaluating learning outcomes (Hess & Greer, 2016; Stanny, 2016). The ARCS-V model was chosen to produce a motivational design model for the framework consisting of motivational elements (Keller, 2016; Khan et al., 2019).

RQ1.4: **How can the framework be used to develop an emerging technologies course such as an Online *Virtual Reality Development course?***

Virtual Reality (VR) has grown, and future growth is set to expand even further (Costello, 2019). This growth will mean that more developers and content creators are needed (Costello, 2019). Educators are in a position to create online courses that cater to the potential student that will want to enter the VR Development field.

The requirements for current VR applications were evaluated and the Online Course Development Framework (OCDF) were used as a basis to create an Online Virtual Reality Development course outline. Creating an OCDF and course outline for an Online Virtual Reality Development course will aid educators in building online courses for current and emerging technologies.

3 RESEARCH METHODOLOGY

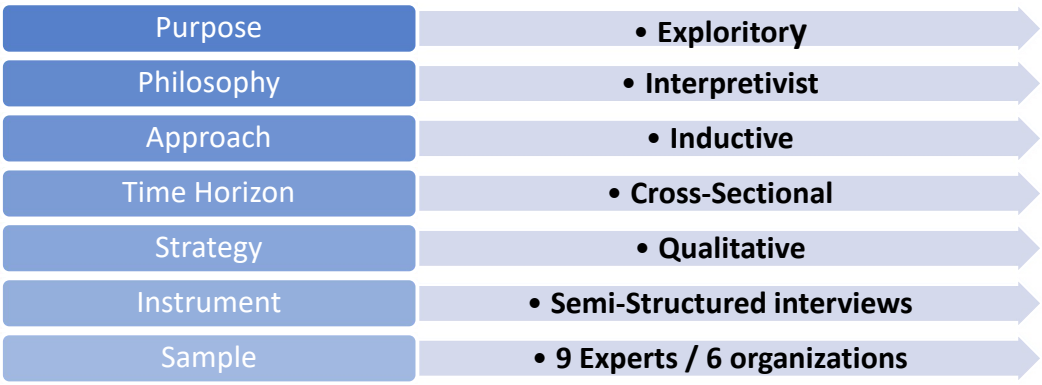


Figure 5. *Research methodology.*

A research design methodology was used in the collection of the study data to develop and test an Online Course Development Framework (OCDF). The research design choices were analysed using the methods Saunders, Lewis, and Thornhill (2019) stipulates and depicts with the 'research onion' approach shown in Figure 4 as a guide. The onion design uses different layers of research design to explain the possible design choices process (Saunders et al., 2019).

The research methodology section explains the time horizon, research strategy, methodological choice and approach. Furthermore, it explains the study's research philosophy. It continues to discuss the sample size and population, the research instrument and the procedure of data collection as well as the validity. It then continues to cover some assumptions and finally discusses the study ethics.

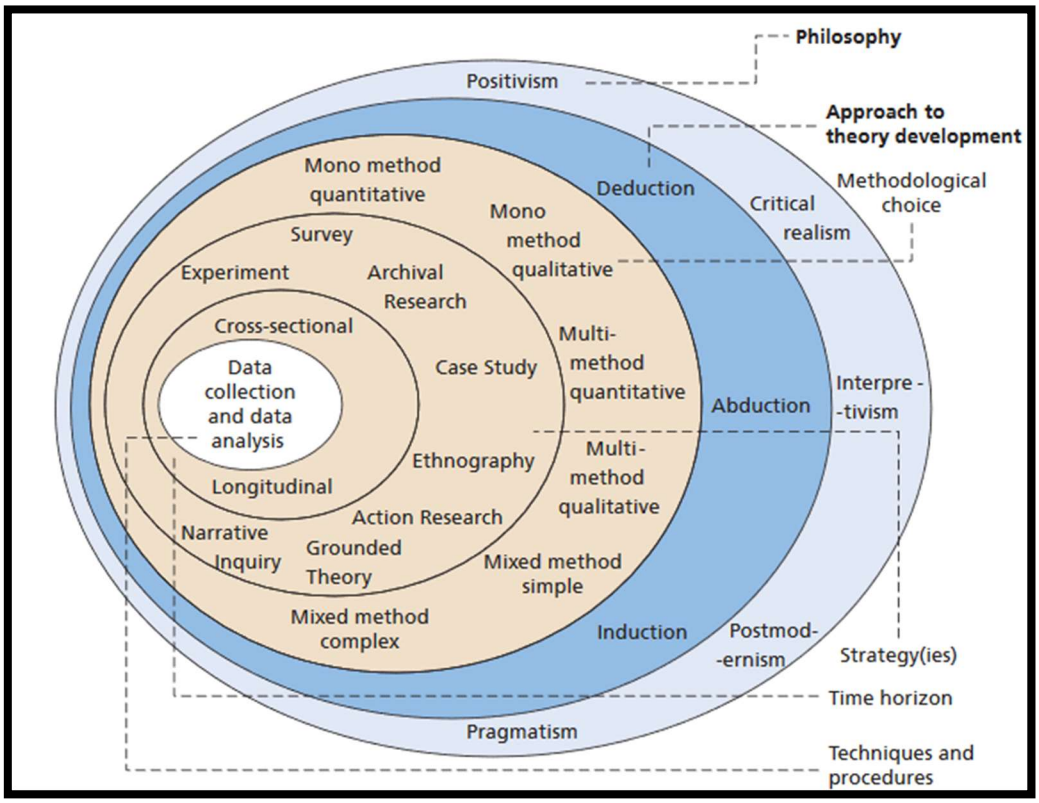


Figure 6. *The 'research onion' (Saunders et al., 2019).*

3.1 Research Time Horizon

The research time horizon used in this study was cross-sectional study. A cross-sectional study refers to the collection of data are from a sample that are collected at a single point in time rather than over a long period of time such as in a longitudinal study (Sedgwick, 2014). Since the study was on developing an Online Course Development Framework and using an Online Virtual Reality Development course as a test case, a longitudinal study would not be applicable as the need for long term feedback is not required (Sedgwick, 2014). However, cross-sectional studies can be used to repeat studies at different times to investigate changes in trends or outcomes, if attention and caution is exercised when different participants are used each time (Sedgwick, 2014).

3.2 Research Method

The study conducted a literature review to discover and explore learning theories, learning design methods and models that would prove useful in developing an Online Course Development Framework (OCDF). By first exploring the literature it was discovered that the ADDIE Instructional Design model would work well with the Bloom's taxonomy to create a framework. Furthermore, it was discovered that Constructivism learning theory and the ARCS-V model to motivational design would lend itself well to developing the OCDF.

To validate and test the framework, the study collected data by using a semi-structured interview process. Before deciding on the semi-structured interview process, both unstructured and survey processes were considered. However, by using semi-structured interview attention can be placed on the individual experience and subjectivity (Tracy, 2013). Semi-structured interviews provide an opportunity for detailed investigation of people's personal perspectives, for an in-depth understanding of the personal context within which the research phenomena are located, and for very detailed subject coverage (Myers & Newman, 2007).

The study was only conducted after consent was requested and received from the respondents. After approval and consent was received, data was collected by recording interviews using video chat services such as Skype and email in cases where the interview could not be conducted via Skype because of time constraints or schedules. The interviews were coded using qualitative data analysis methods to analyse the data inductively. The interviewee's behavior was also observed and noted where applicable to the study.

3.3 Methodological Choice and Research Approach

The study used qualitative methods to gather and examine data. Qualitative methods refer to broad terms that describe the data gathering, examination of context, and understanding of interviews, observation and documented data to make sense of and describe meanings (Tracy, 2013). In qualitative methods, the data is analysed by interpreting behavior and responses from the researchers' viewpoint and is context specific (Tracy, 2013). Qualitative research methods are particularly effective when detailed data is to be gathered about implementation, identifying and understanding change as well as subjectively understanding motives (Fraser, Tobin, & McRobbie, 2012). Thus, qualitative methods were chosen to gather info about past implementations and views about theories and frameworks as the respondents could discuss their experiences and provide insight into the phenomena of online education.

Additionally, the study chose an inductive approach to research. The inductive approach to research differs from a deductive approach in that it is more flexible and can explore extra phenomena before making conclusions (Saunders et al., 2019). The research took an inductive approach due to the importance of acquiring subjective viewpoints and interpretations from subject matter experts in applying learning theories, motivational and design models to a framework. Using the inductive approach gives the research the flexibility in that the knowledge can be built from the bottom up by observing and interacting both with literature and by conducting semi-structured interviews with subject matter experts (Tracy, 2013).

The study conducted semi-structured interviews to validate the proposed framework for an online course using Virtual Reality development as a test case. The respondents are skilled subject matter experts in education and online education, thus each having possible unique viewpoints based on their experience.

In order to conduct an efficient interview, the interviewer needs to be mindful of certain problematic aspects of an interview. Interviews can feel artificial since the interviewer is asking questions on the respondent without knowing them and this can create insincere responses (Myers & Newman, 2007). Lack of time to conduct the interview can also constitute a

problem in that the data gathering lacks substance and could be incomplete (Myers & Newman, 2007). By taking note of the potential pitfalls when conducting an interview, the problematic aspects can be minimized.

3.4 Research Philosophy

The research philosophy that was applied is an interpretive philosophy approach for data collection. This philosophy implies that the data is constructed socially and that the data is subjective (Myers & Newman, 2007). Subjective data may change as social theories change and this brings complexity to the sense making process. Thus, an understanding is obtained by taking into account the inherent subtilities and differences that come with experience and social changes (Myers & Newman, 2007). The research study focused on gathering data from respondents in an interview using semi-structured interview questions. The responses and interpretation are attributed to the subjectivity and motivation of the responses.

3.5 Sampling

The research considered two sampling methods, judgemental sampling and expert sampling. Expert Sampling was chosen as the correct sampling approach for this study. Using expert sampling the study can gather information from the respondents with expert knowledge relating to the study directly (Etikan, 2017). The selection of population was representative of subject matter experts in the online courses sector from South Africa, Netherlands and Norway. The sampling size was between 1 and 3 staff members from the 6 different educational organisations that have expertise in online course development. Using the expert sampling method, the study could gather data directly from specialist individuals. The names of the respondents were omitted for ethical reasons and were replaced by codes as explained in 4.2. The sample could be kept relatively small as the subject matter experts have relevant expertise in online course development, online learning, learning theories and online pedagogy. Thus, by keeping the sampling size small and using qualitative and inductive approaches, more in-depth focus data could be gathered (Neuman, 2011). 8 Out of 10 experts approached responded to the pre-framework interview. The response rate for the pre-framework interview was thus 80%. 11 Experts were invited for feedback for the post-framework and 6 responded. The response rate for the post-framework was thus 54%.

3.6 The research instrument

The research instrument as shown in Appendix A, takes the form of semi-structured interview questions. By conducting semi-structured interviews with subject matter experts in online education, the online course framework can be tested for validity and usefulness (Cohen & Crabtree, 2006). By conducting semi-structured interviews, the interview can be guided to extract information that has been identified but still leaves open the possibility of gathering data that was unaccounted for or not expected (Myers & Newman, 2007). Semi-structured interviews provide qualitative data that are reliable and comparable (Cohen & Crabtree, 2006). The questions were formulated by the literature findings from the literature review to verify elements from a learning development framework perspective and discover if the research aligns with current

industry perspectives. Furthermore, the second round of questions was formulated to test the framework and its effectiveness in providing a useful aid in designing online courses.

Permissions needed to be obtained to conduct the interviews from the respondents. A letter was also included to explain the research and motivate the potential interviewees to participate in the study.

3.7 Procedure for data collection

While conducting the semi-structured questions the data is collected by recording Skype and face to face interviews with permission of the respondents. Whilst most of the interviews were conducted over Skype, some respondents responded by using questions emailed to them and then replying in text form. This was done to be able to get the data from respondents in a timely fashion since the respondents could not conduct the interviews at the time using Skype. The data of this collection method did not skew the results since bot the interviewed respondents and the emailed respondents had enough time to answer the questions. The interviews were transcribed. The second round of questions post-framework was collected via email questions that were emailed. Data was then imported into Excel, the data was analysed, coded using thematic analysis and interpreted.

3.8 Limitations of the study

The limitations of the study are:

The study was conducted using a cross sectional approach. However, a longitudinal study would have provided more time to put the framework to the test on more courses as well as given more time for respondents to comment. Thus, more in-depth data could be gathered over time to refine and improve the framework as well as document findings.

Geographically the study conducted interviews with institutions in the Netherlands, Norway and South Africa. This limits the scope of findings to educational organisations from these countries.

3.9 Validity and reliability

3.9.1 *External validity*

The sample size was relatively small due to cross-sectional outlook. However, the sample criteria had a broad reach in that all leading educational institutions have knowledge in the area of course development and course delivery.

3.9.2 *Internal validity*

Pre-screening due to needing to explain the study to the participants of the survey could have introduced bias in one way or another. Either for, or against, specific assumed outcomes (Lub, 2015). The study attempted to keep explanations to only the necessary to avoid providing any insight bias into the study prior to participating in the interviews.

3.9.3 *Reliability*

To increase the reliability of the research and data, the analysis process was described in detail explaining the context and method of the data collection and sampling size. Peer-reviewed journals were used where applicable to back up claims. Furthermore, the research questions were kept to a minimum in order to acquire the sample data needed (Elo & Kyngäs, 2008). However, a semi-structured interview approach was followed to allow for additional insight based on experiences from experts.

3.10 Assumptions

The following assumptions were made:

- That the interviewee has a solid understanding of either online learning or traditional learning approaches.
- That the interviewee has a solid understanding of learning theories or can relate their experience in learning to learning theories even if they don't know the theories.
- The research assumed that data gathered from experienced and leading subject matter experts would be sufficient to reproduce a valid argument for developing an online course framework.

3.11 Ethics approval

Approval was obtained from each of the respondents before an interview. The respondents and the organisations privacy and confidentiality were strictly preserved, and no identifiable information was kept on record.

3.12 Risks

The risks that this study could have encountered, along with mitigating factors are listed below:

- Timing constraints. The timeline for the research is relatively short by adhering to a timetable the research stages were completed on time.
- Approval delay: Delays of research design acceptance and ethics approval. By submitting the correct documentation on time, the delay was minimal.

- Interview respondents unable to conduct an interview. There were some respondents that could not conduct either of the two interviews in the timeframe. To eliminate this risk interview questions were emailed, and respondents replied in text format. Where this could not be accomplished secondary respondents were contacted.

4 DATA ANALYSIS METHODS

Preceding the development of the framework and course outline, the research data was analysed to learn more about the use of theories, models and frameworks with regards to course development. The study was guided by the literature review and research questions derived from the literature review. The study made use of a thematic analysis approach to analyse the data from the semi-structured interviews. Two rounds of interviews were conducted. The first round consisted of the respondents answering questions before the Online Course Development Framework (OCDF) was developed since the framework would be developed taking the responses into consideration. Thereafter an Online Virtual Reality Development (OVRD) course outline would be created based on the framework. The second round of interviews was conducted after showing the respondents the (OCDF) and (OVRD) course outline before they responded. By using two rounds of interviews, namely the pre-framework and post-framework interviews, more in depth data could be gathered to test the framework as well as a course outline created by using the framework.

4.1 Analysing the data

The data gathered from the two rounds of semi-structured interviews followed the six step approach of the thematic analyses defined by Clarke and Braun (2013). The thematic analysis approach is in its basic form a method for identifying, classifying and examining the content in qualitative data (Clarke & Braun, 2013). Qualitative data analysis is complex and diverse with many nuanced aspects. By using thematic analysis as a fundamental method of data analysis, many different forms of qualitative data can be analysed effectively (Braun & Clarke, 2006). Thematic analysis is useful when analysing data from a wide range of questions, experiences and understandings. Furthermore, it is useful when working with large or small datasets across varying data types such as secondary data, transcripts, interviews and other text (Clarke & Braun, 2013). The six steps of the thematic analysis approach that the study used are shown in Figure 7.

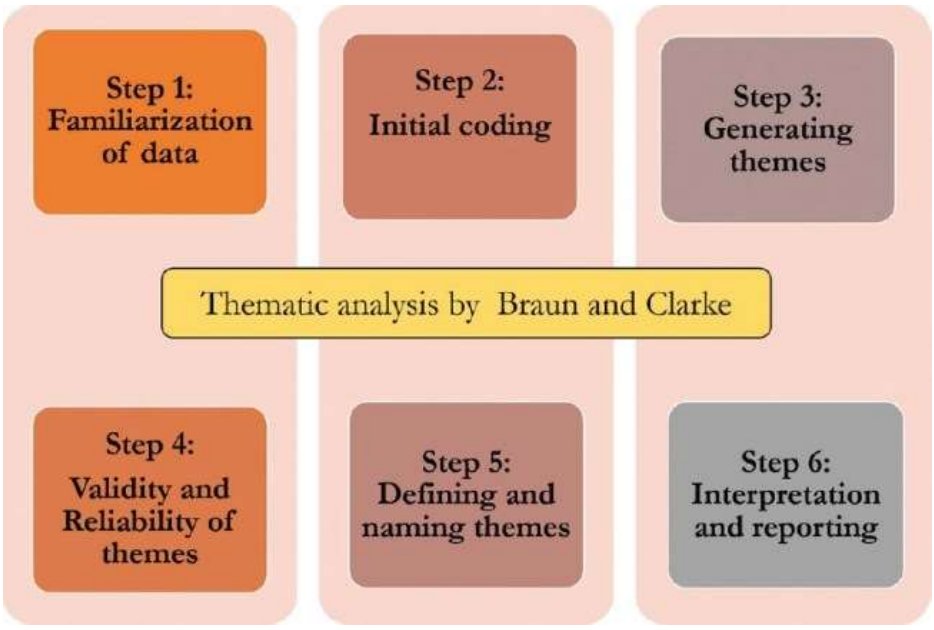


Figure 7. *Thematic analysis* (Prashanti & Kumar, 2016).

1.) Familiarization of data

It is essential that the researcher familiarises themselves with the data and takes note of any analytical observations. This is a common element in qualitative data analysis (Clarke & Braun, 2013). The data familiarisation process encompassed listing to the audio recordings and reading through the transcripts. Then following that, another pass through of the data was done before the initial coding of the data was done using Microsoft Word. After that process was complete the next step was to do the initial coding of the data.

2.) Initial Coding

Coding of the data is also a common element in qualitative data analysis. By generating the initial codes and meticulously labelling the critical data and using the research questions as a guide, the coding can reduce data. Furthermore, the coding provides an analytical structure to the data. The process of coding the data and organizing it, forms part of the analysis (Braun & Clarke, 2006). Thus, capturing both conceptual and semantic elements of the data. This step ends with the researcher collating all the data codes and all the research data extracts (Clarke & Braun, 2013). Initial coding was done in an iterative process, coding was done in the first pass over the data, then a 2nd and 3rd pass.

The data was coded using processes derived from the Simplified Qualitative Data analysis techniques using general purpose software (La Pelle, 2004). Using Microsoft Excel and Microsoft Word enabled a detailed analysis to be done in a satisfactory manner. Figure 8 shows how the data is coded in the Excel spreadsheet after the three rounds of passes through the data.

1	Organisation	R Code	Question	Miscl	Theme	Links	Theme Code
122	ORG6	SAF8	Student centric Constructivism (depending on the course)			(Constructivism)	LT1.c
123							
124			**If you have applied a learning theory to your development, on a scale of 1-5, 1 being not at all and 5 being extremely close, how close do you follow it?**		Learning Theory		LT1
125	ORG1	SAF1	None				
126	ORG1	SAF2	None				
127	ORG2	NED3	None				
128	ORG3	SAF4	3				
129	ORG4	NOR5	4				
130	ORG4	NOR6	2	As close as possible given the time constrains. Probably a 2 over the entire course but a 5 for selected key components.			
131	ORG5	SAF7	None				
132	ORG6	SAF8	4	Fairly course specific, depends on the university partner			
133							
134			**Why do you follow the learning theory as closely or not as closely?**		Learning Theory		LT1
135	ORG1	SAF1	None				
136	ORG1	SAF2	None				
137	ORG2	NED3	None				
138	ORG3	SAF4	I get a feeling for it, depending on the need If a lecturer wants to do some sort of technology supported learning they can't stand back from the technology, they have to engage themselves			(Feel)	LT2.a
139	ORG4	NOR5	This is a good indication of how one should develop a course to fit the different purpose and group that one targets. This has a major input into the assessment criteria and delivery method				
140	ORG4	NOR6	Time and resources.			(Time and Resource)	LT2.b
141	ORG5	SAF7	None				
142	ORG6	SAF8	None				
143							
144			**Have you heard of the ADDIE Instructional Design model?**		Course Design		

Figure 2. After 4 rounds of coding: Themes and coding showing links to theme.

Each question was entered in the 'Question' column., Miscellaneous data that was of relevant to explain data from the Questions field was added to the 'Miscl' column. Themes were established, coded and are listed with the links to the themes in columns named 'Theme' and 'Links'. Recording memos continued in parallel with the coding of the data and supported the defining, naming, and grouping of the different categories (Charmaz, 2006). Responses were captured under the 'Question' column in each row, per respondent. The themes were frequently revisited as well as renaming them as per Urquhart, Lehmann, and Myers (2010) as interviews were compared and literature examined.

The Organisation and Respondents codes are shown in the first two columns named 'Organisation' and 'R Code', the questions are shown in the third column. Firstly, the organisations were numbered in the 'Organisation' column. At the coding stage the respondents' real names were omitted and replaced with codes in the 'R Code' column. **SAF1**, **SAF2**, **SAF3**, **SAF4**, **SAF7**, **SAF8**, **NED3**, **NOR5**, **NOR6** and **NOR9**. **SAF** = Respondent from a South African organisation, **NED** = Respondent from a Netherlands organisation, **NOR** = Respondent from a Norwegian organisation.

from a Netherlands organisation, **NOR** = Respondent from a Norwegian organisation.

Table 1. Profile of respondents Pre-Framework

Organisation number	ORG1	ORG1	ORG2	ORG3	ORG4	ORG4	ORG5	ORG6	ORG4
Respondent number	SAF1	SAF2	NED3	SAF4	NOR5	NOR6	SAF7	SAF8	NOR9
Role	Professor	Professor	Professor	Instructional Designer	Assistant Professor	Professor	Professor	Content, Quality Assurance	Teacher / Student Support Services
Years in current role	19	8	5	5	0,75	4	11	0,33	1
Years experience in Educational Sector	19	7	27	25	5	25	18	U	11
Years in Online Education	4	6	2	20	2	10	2	U	1.5
Number (+-) of online courses the respondent's organisation provides	U	200	2	4	25	25	50	110	U
Average of students enrolled in an online course	Between 40 & 70	"1000's"	Between 34 & 1015	25 x 4 groups = 100	Between 100 & 1000	Between 20 & 200	Between 2000 & 3000	Between 70 & 700	U
Participated in Pre-Framework Interview	Y	Y	Y	Y	Y	Y	Y	Y	N
Participated in Post-Framework Interview	N	N	Y	Y	Y	Y	N	Y	Y

KEY: U = Unkown | Y = Yes | N = No

Table 2. Profile of organisations in response (Pre and Post Framework).

Organisation	Number of Pre-Framework Respondents	Number of Post-Framework Respondents
Educational Organisation 1 - South Africa	2	
Educational Organisation 2 - Netherlands	1	1
Educational Organisation 3 - South Africa	1	1
Educational Organisation 4 - Norway	2	3
Educational Organisation 5 - South Africa	1	
Educational Organisation 6 - South Africa	1	1

3.) Searching / Generating of themes

Clarke and Braun (2013) describe the theme from the Thematic analysis as being a meaningful and coherent pattern in the data that is applicable to the research questions. Furthermore, themes are not hidden in the data but rather, the data is used by the researcher to construct a theme and group the codes in similar meaningful data. At this stage a sense of significant and meaningful data starts to be revealed, but no data is disregarded.

The development of categories, and links (relationships) are iterative in nature according to Pandit (1996), as the processes of coding, as well as associating and defining occurred in parallel and not in a procedural manner. The interviews were all re-analysed after each round of the two interviews, pre-framework and post-framework, and the significant links to themes highlighted and checked.

4.) Reviewing of themes (Validity and Reliability)

In this step, the themes that are relevant to the research questions are being reviewed. The researcher reflects on the coded themes and data to see if the themes correlate with the coded data and the full extracts. In this step the themes can be disregarded, grouped or split off from one another. If the themes do not correlate it is possible that the data coding of themes was incorrect and should be revised (Clarke & Braun, 2013).

5.) Defining and naming themes

By asking what 'story' a particular theme tells, how it fits in with the data and research question, the theme was named and defined in an informative way (Clarke & Braun, 2013).

6.) Interpretation and writing (Reporting)

Interpretation and writing are an integral part of the process of thematic analysis. This step involved collating and putting together the analytic narrative and data extracts to provide a clear picture of the research conducted. Furthermore it needed to be contextualized in the relation of the existing literature in a way that tells the reader a coherent story about the data (Clarke & Braun, 2013)**.** The study also used Microsoft Excel to visualize the data.

It is important to note that Clarke and Braun (2013) mention that it is not deemed necessary to follow the six steps in sequential order in a linear way, but instead that the analysis is a recursive process.

5 RESEARCH FINDINGS

The findings are discussed in two parts. The first part discusses the research findings pre-framework. Thus, the research findings based on questions to gather data for the development of the Online Course Development Framework (OCDF) and Online Virtual Reality Development (OVRD) course outline. The findings of the Literature Review and Pre-Framework research were then used to develop the OCDF and OVRD course outline. The respondents were then invited to respond to post framework questions after the respondents were presented with the OCDF and the resulting OVRD.

The research questions are presented with the findings and then summed up in Figure 19, at the end of the research findings.

5.1 Research analysis and discussion: Learning Theories (Pre-Framework)

To answer **RQ1.1** and **RQ1.2** both the literature review from 2.3 and the respondents results from the pre-framework questions were taking into account.

RQ1.1: Which learning theories could be used to construct a useful framework for developing online courses?

RQ1.2: Could any of these theories be used to develop courses in emerging technologies such as an Online Virtual Reality Development course?

The literature review in 2.3 found that there are many different learning theories and that many of these theories can be used to develop online courses with as Arghode, Brieger, and McLean (2017) points out. One specific theory seemed to be especially suited for an online course such as an Online Virtual Reality Development course and that is the constructivism theory (Bada, 2015; Scoppio & Luyt, 2017). This study queried educational experts with regards to learning theories and course design. The respondents had a wide range of different opinions of which learning theories are used, if at all, and what constitutes a good course design process. These varied opinions can be contributed to varied experience within given areas of teaching.

Within course design and development five out of eight respondents in the pre-framework interviews claimed to use some form of learning theory. The research findings resulting from the respondents indicate that specific theories are considered. The respondents named Activity Based Learning, Bloom's Taxonomy and Constructivism. One respondent uses Brain Compatible Learning principles, however this is not a learning theory but an educational approached based on neuroscience and the biology of learning (van Niekerk & Webb, 2016).

NOR6: *"No theories, but close adherence to brain compatible learning principles. BCE."*

The findings show that the educators develop their own content from the ground up or a combination of developing their own content and using existing content. Not one respondent replied that they only use existing material.

Table 4. *Do the respondents follow learning theories?*

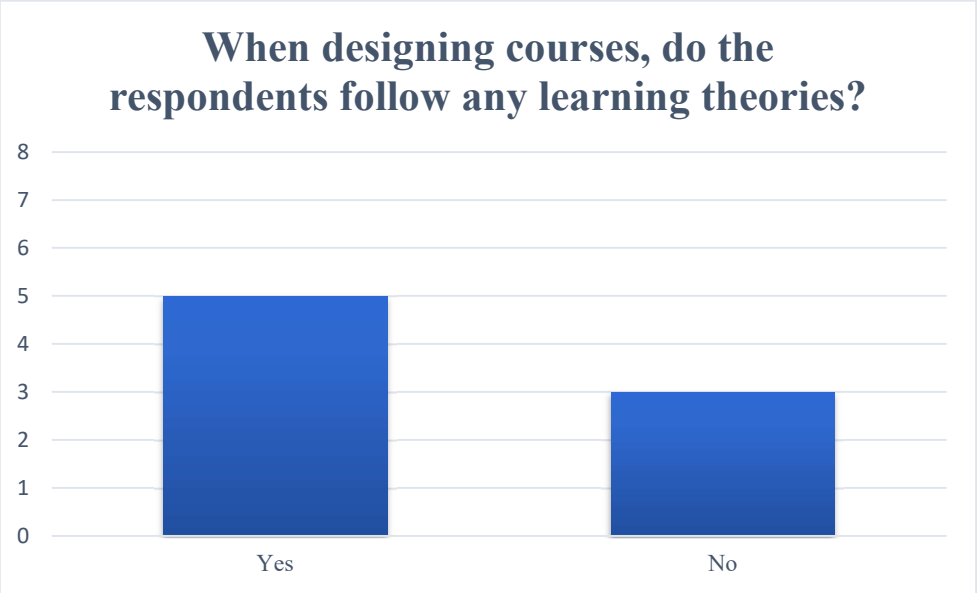
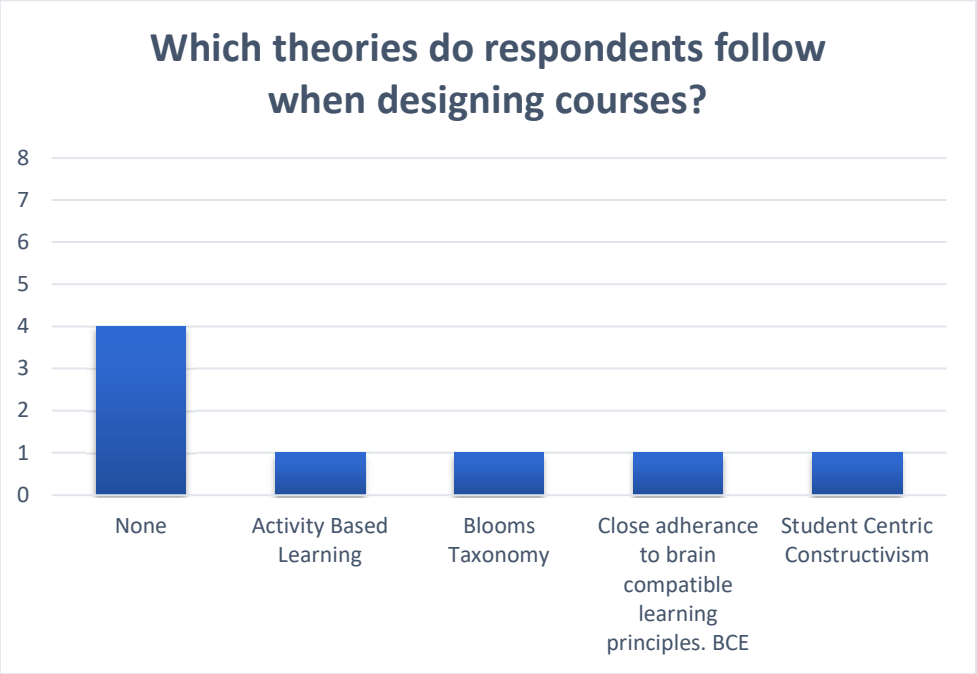


Table 5. *Learning theories that respondents said they used.*

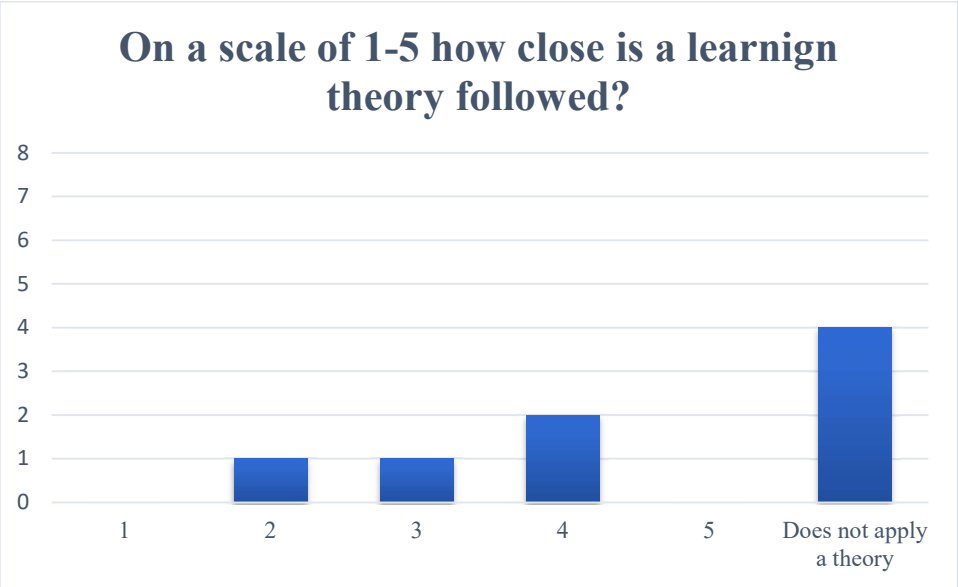


The respondent's replies indicate that they might be using aspects of learning theories even though it is not explicit. Respondent **NED3** said that they do not use a theory, but they know what works in their courses and what does not.

NED3: *"I don't use that. I just work with a structured course structure. I don't follow any particular method. It's a personal thing, but over the years you develop a feeling for what works in the particular area and in many of these theories is not applicable, especially in a field that is fairly new and where you are starting to discover what is important.*

When the respondents were asked to place a value on a scale of 1 to 5 on how closely they followed the learning theory mentioned in Table 6 the results indicate that of those using a learning theory 2 respondents followed it relatively closely at 4 out of 5.

Table 6. *How close were learning theories followed on a scale of 1 (not close) to 5 (very close) – Also indicated is the respondents who does not apply a learning theory.*



When inquiring why respondents follows or does not follow a learning theory it was established that the lack of time and resources plays a role when they did not use it. However, those that did use it mentioned that it plays a role in how the courses are developed. This is in line with the literature review on learning theories as discussed in 2.3.

Those who follows the learning theory closely indicated that it's a good indication of how to develop a specific course responding that, **NOR5:** *"This is a good indication of how one should develop a course to fit the different purpose and group that one targets. This has a major input into the assessment criteria and delivery method"*

The finding is noteworthy especially in relation to **RQ1.2** in that by outlining how a student learns and acquires knowledge courses can be developed in such a way that aligns to the specific area of study so as to aid educators to choose a learning theory as a guiding principle of an overall course design. A learning theory for courses in emerging technologies such as an Online Virtual Reality Development can make use of the constructivist learning theory for example and can be very useful from a course design approach to establish importance of what types of learning will take place.

Interestingly, a learning theory that is used by respondent **SAF8** is Constructivism. This is in line with the findings that was discovered through the literature review in 2.3.4 for use with online courses where the focus is heavily learner centric.

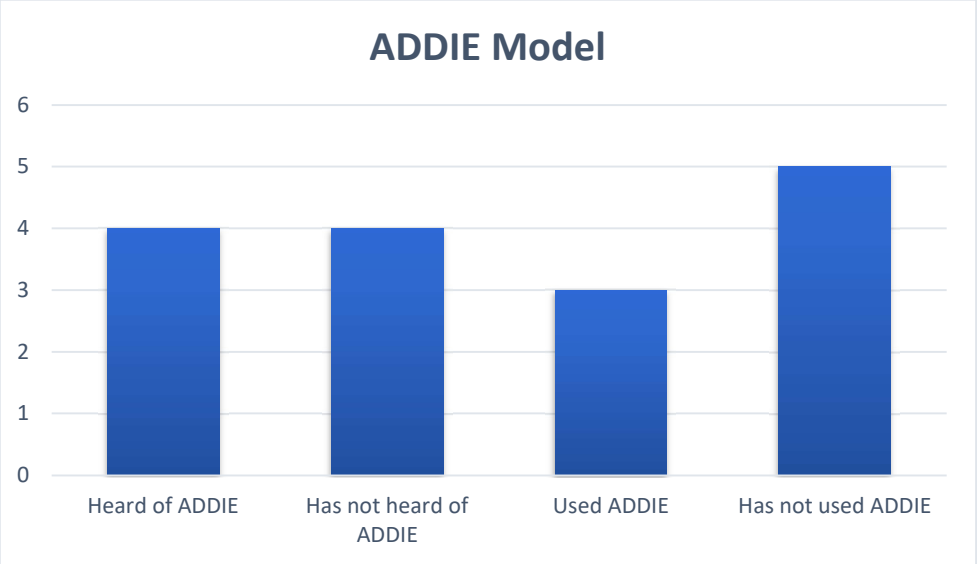
However, even though most of the respondents said that the do not use a learning theory, many said that they might use elements of it without knowing. Thus, it is probably fair to assume that the respondents have acquired a 'feel' for what works for the students and thus unknowingly use elements of theories even though they don't align it to the specific topics. This could also indicate that using a learning theory to guide the overall design of a course is perhaps not as important as that of experience in course design and teaching. Regardless, the research has recommended in the OCDF that a learning theory can be considered when designing the course as the literature review indicated that it is indeed important and useful.

A learning theory and philosophy that can be considered and has been noted in the OCDF is that of constructivism. Constructivism theory is a suitable theory for emerging technologies as it encourages active learning and building on previous knowledge, which is suitable for courses such as the OVRD course. Choosing a fitting learning theory would enable the educator to decide which types of learning activities and assessments to create.

Course Design and Development – Instructional Design and Motivational Design:

When the literature review was conducted it became apparent that the ADDIE Instructional Design model was touted as very significant in the Online learning field as discussed in 2.5 (Budoya et al., 2019). The ADDIE Model was thus chosen as an Instructional Design Model for the OCDF. The OCDF incorporated ARCS-V as a motivational model (Keller, 2010, 2016). When the respondents were asked if they have heard of the ADDIE model, surprisingly, half of the respondents has not heard of the model and only three had used the model before as shown in Table 7.

Table 7. ADDIE knowledge and use.



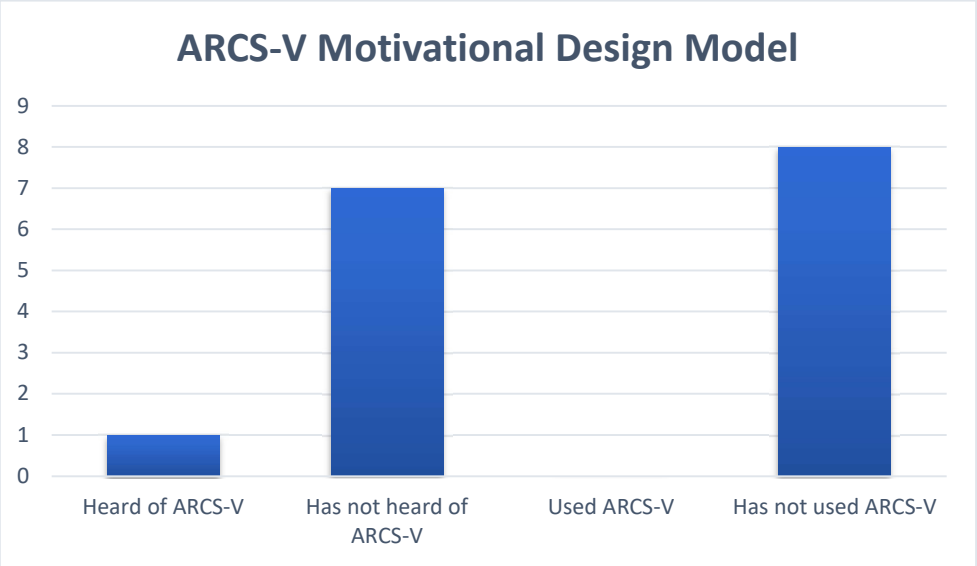
One respondent gave a reason for this. **SAF1:** *"One doesn't use one approach alone. I read a lot about teaching and about learning …… it's difficult to keep the motivation…… I probably use parts of it but I don't use it in a formal manner. ……I may use aspects of ADDIE but I wouldn't necessarily follow it to the T."*

The research discovered through the literature review that keeping learner motivated is an extremely important aspect of developing successful instructional content. Similarly, motivation and keeping motivation in courses resonated with the respondents as an important aspect and an issue. None of the respondents used formal models or theories to motivate students.

ARCS-V was identified in the research from conducting the literature review 7.2 as a potentially positive model to introduce as an overarching motivational model in the OCDF. When inquiring from the respondents if they have heard of the ARCS-V model or have used the ARCS-V model only one respondent has heard of the model and no respondents have used the

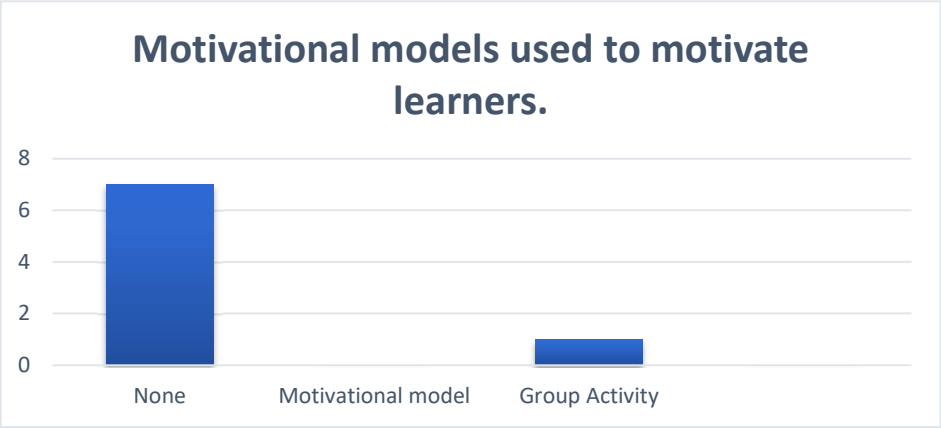
model at all. See table 8. This could indicate that the ARCS-V model is not as popular or that the respondents did not know about the model.

Table 8. Respondents knowledge and use of ARCS-V



However, given the experience level of the respondents and the high level of interest in the motivational aspect of learners, the research expected that the respondents would uses some sort of motivational design or model in their course development. Further data from the interviews concluded that no respondents used any models or frameworks as guide to motivate student as can be seen from the data in Table 9. Respondent **SAF7** Mentioned that they do not use a model but that *"Group work"* or *"Group activities"* to help motivate learners. This finding is quite surprising when considering how high the importance of keeping learners motivated ranked with the respondents.

Table 9. *No motivational models were used by respondents to motivate learners.*



The following notable comments with regards to learner motivation was made by the respondents:

NED3: *"…once they've lost interest it is very difficult to pick it up again.", "If you don't force them to do assignments to keep busy, they will tend to drop out."*

SAF4: *"It depends on why the student is there doing the course, is it because they were told that they have to be there or because they're interested. Part of the motivation is why they are there in the first place. I'm interested in you speaking about a motivational model because if one can include that in one's course design, that will promote sustainability."*

NOR5: *"This is very challenging no matter where you are. I like to motivate students by showing them a functional and practical use of every concept they learn. I try to make it relevant to them as individuals. Also, with slightly dull content, passion makes a huge difference…"*

The data from the answers toward the motivational model questions indicates that the respondents do not use motivational design models in the course design. However, the qualitative data analysis produced more data that shows that it does not necessarily mean that there are no motivational elements included in the design. When theming the responses from the respondents and mapping it to the ARCS-V motivational model when the educator was describing elements of ARCS-V unknowingly, the responses showed that many of the respondents are indirectly considering elements of ARCS-V as important. Relevance of the course and keeping attention of the learner ranked the highly when they are designing courses, see Table 10. This is confirmed in the literature review with the discussion of the ARCS-V model (Keller, 2010). The finding is significant as this indicates that including the ARCS-V model into a course design framework might prove to be of use to educators and provide a positive impact.

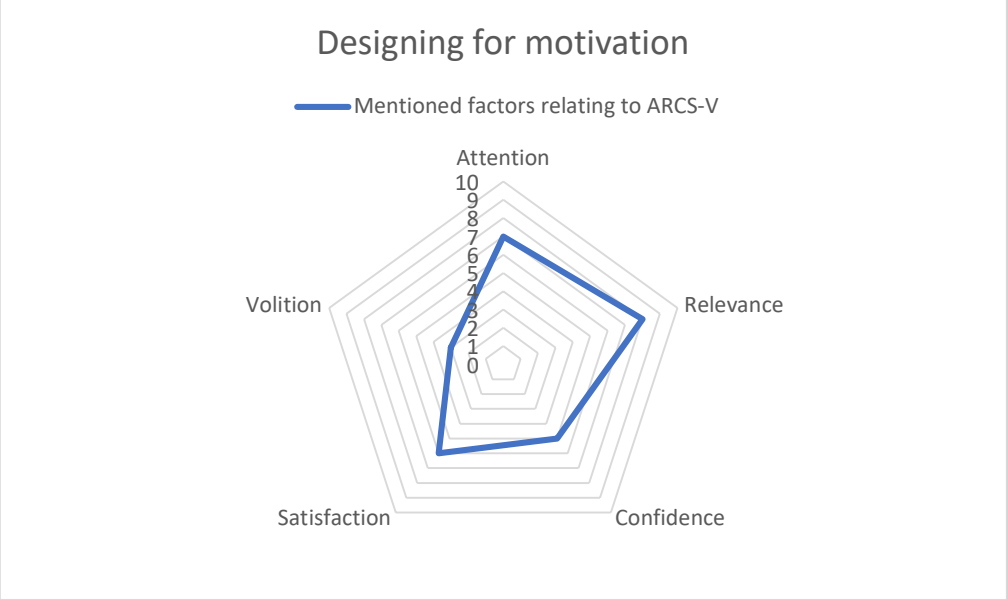
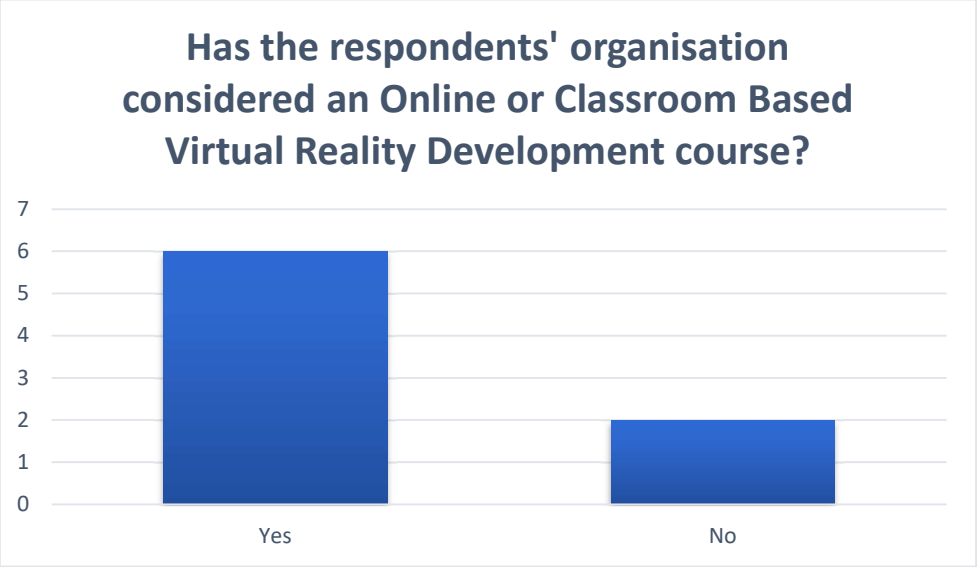


Figure 9. *How many times respondents mentioned factors that relate to ARCS-V over questions that was asked about motivation. Relevance and attention were mentioned frequently as crucial factors in designing for motivation.*

Virtual Reality Development course:

To support the testing of the OCDF for creating courses for emerging technologies the OVRD course outline was created. Before creating the course outline for the OVRD course it was important to get information regarding a course. The course choses as a test case was VR Development as discussed in 2.8.1. The feedback from the respondents with regards to VR and VR courses were collected. Six out of the eight respondents mentioned that they or their organisation has considered either a classroom based or online based virtual reality course of some kind. See Table 10.

Table 10. *Most respondents have considered an Online VR Development course*



When discussing what is keeping the respondents' organisations from implementing a VR course it stood out that it was not relevant to six of the eight respondent's organisations as shown in Figure 10.

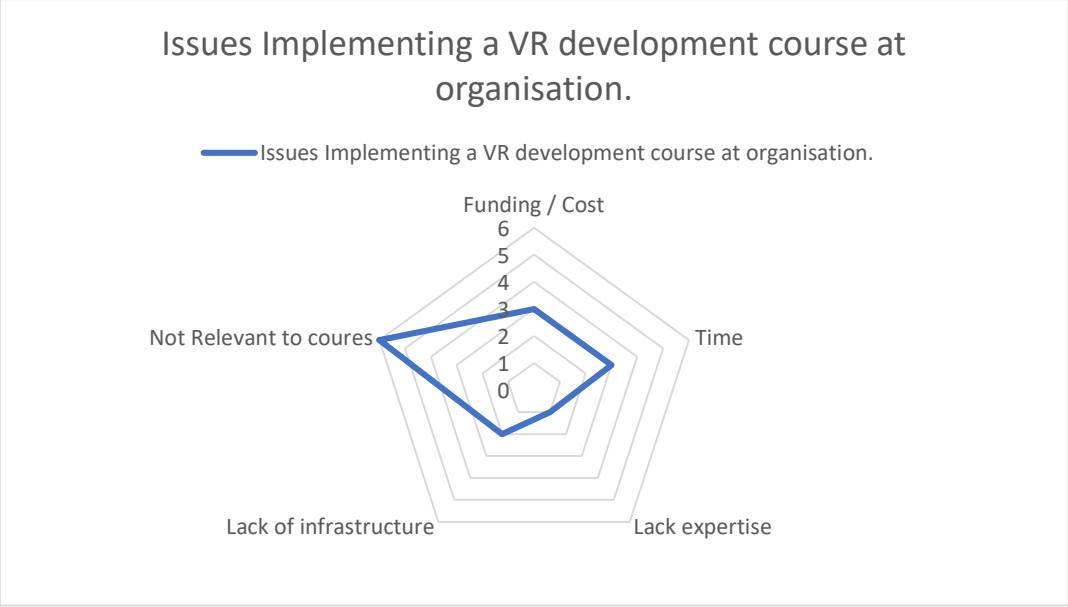


Figure 10. *The issues that the respondents described in implementing a VR development course. Most cited that such a course would not be relevant to them. Funding and time also played a role in implementing an Online VR Development course.*

The respondents refered to aspects that they feel would be important in a successful Online VR Development Course delivery namely different implementation techniques, benefits of VR and relevancy of real world concepts.

Referring to VR the following noteable comments was made:

NED3: *"They will need to know how to code these things and have experience in that. The one big problem would be the availability of physical resources like the Holo Lense or a device that can be used for the development, it's not cheap. The rest is pretty similar to any other course but they need to have a good understanding of coding or development to use these things"*

NOR5*: "I think it is very important to make people aware of the benefits of having VR. Also, they need to experience it themselves to fully utilise the potential. Also, it is important to understand the different implementation techniques and usages of VR."*

NOR6: *"The VR aspects should be relevant. It should be VR to teach a real world concept where this matters…..Not VR for the sake of using technology"*

These responses would indicate that there might be interest in developing Virtual Reality courses but that there is not a current need in the orginisation currently. The reasons for this could be a for few reasons, but as was discovered in the literature review it could mean that the organisations would be late to adopt an emerging technology like VR (Costello, 2019; Panetta, 2018). Contrary to late adoption the finding could also be less focus on emerging technologies and more focus on currently popular courses so as to keep student numbers high.

5.2 Post-Framework

When researching the learning theories discussed in 2.3, it became apparent that many theories could be used to construct an Online Course Development Framework (OCDF). It was essential to define what the subject of the learning was, in order to establish the correct learning theory to model a framework on (Arghode et al., 2017; Dumford & Miller, 2018; McIver et al., 2016). In this case the subject was Virtual Reality (VR) development. As explained in section 8.1, VR is an emerging technology and this led to a search in discovering what learning theories, models could be used to build a framework for online courses. The mixed project-based approach that an Online Virtual Reality Development course required the need for a theory that can be used to draw knowledge from various different areas (Liagkou, Salmas, & Stylios, 2019). Thus, the framework needed to make use of a learning theory that promotes an open approach to design interpretation as well as build upon previous knowledge gained as the student progresses through the course. Constructivism fulfils these requirements as discussed in 2.3.1 (Harasim, 2017; Jiang, 2019).

ARCS-V was used in combination with the constructivist theory and Bloom's Taxonomy to develop a framework for an Online Virtual Reality Development (OVRD) course outline. The ARC-V motivational model is used to establish motivation as a key guiding principle in the course outline. Although ADDIE has been previously used with the constructivist theory as shown in the paper by Trust and Pektas (2018) , ARCS-V adds the required motivational elements as it allows for a motivationally aligned learning methodology while being flexible and focuses on learners. Bloom's Taxonomy establishes the learning levels of the learning objectives.

Similarly, to the ARCS-V model, the constructivist theory discussed earlier focuses specifically on learners. When considering the learner, the constructivism theory takes into account learners' previous experiences and knowledge around the subject (Bada, 2015; Juvova et al., 2015). The ARCS-V model emphasizes the learners' motivation and strives to engage by first grabbing attention, showing the relevance and instilling the confidence that is needed (Keller, 2010; Li & Keller, 2018). Building the OVRD course, the instructor will need to establish motivation as well as provide a non-rigid approach to the students' delivery of activities. The course activities should provide a choice of themes or ask the students to confidently choose their own ideas as a development project and in doing so, provide satisfaction by seeing their ideas brought to reality through the coursework (Keller, 2016; Trust & Pektas, 2018).

The course design for the Online Virtual Reality Development course outline instructions can begin by describing to learners what the course will cover, how the learning builds on previous skills, and what the learner can expect. Using examples that bring the previous experience into consideration, the instructor could develop activities that show how the learning will make use of existing skills (Arghode et al., 2017). The material should clearly point out the learning outcomes that students will accomplish by participating in the learning material and activities (Czerkawski & Lyman, 2016).

The OCDF was presented to the original respondents with the OVRD course outline for feedback. Additionally, to solicit more feedback, one other educator was invited for feedback based only on the framework and course outline after ethics clearance was received. Responses as **NOR9**. The OVRD course outline was created by using the OCDF. The OCDF can be referenced in Appendix B and the OVRD course outline in Appendix C.

Testing the effectiveness of the framework's use the respondents were asked what was effective in the OCDF considering the OCDF and the resulting OVRD course outline. The results were overwhelmingly positive. This indicates that the OCDF is easy to understand and provides a clear process that can be followed. **NOR5:** *"This highlights the correct use of the different concepts (ARCS-V, BLOOMS, etc). Also, the framework is clear in that it shows the required process to follow when developing an online course. The fact that this process has been shown to work (proof of concept) is great."* Further responses seemed very positive about the use of the framework and the way ARCS-V and Bloom's fits together with the ADDIE Instructional design model and the constructivist theory.

SAF8: *"I think it fits it very well. Regardless of the subject matter you are trying to cover, good pedogeological process are a must."*

NOR5: *"The incorporation of Blooms fit quite well. It shows that one has to consider the level of delivering, but also the level when developing the course. Also, the use of the process included in the framework…"*

NOR9: *"The Constructivism Theory is a relevant view of reality in this context as it taps into existing knowledge, then develops on this knowledge to enhance the course. Given that virtual reality is essentially simulated experiences, the theory aligns well as it draws on previous knowledge. With regards to the ARCS-V motivational, these make a valuable contribution to the course development precisely because online students require levels of support and encouragement. Blooms taxonomy assists with measuring the learning levels, thus determining the success levels of the course."*

Further responses indicate that the respondents found that ADDIE used by integrating ARCS-V and Bloom's Taxonomy an effective way to design courses as can be seen from the comments **SAF8** and **NOR9**.

SAF8: *"The use of the ADDIE model is a very effective design tool. The way ARCS-V and Blooms is used in both the design and evaluate phase is also nice to see."*

NOR9: "*The framework is based on tried and tested theories and implements Blooms Taxonomy enhancing its relevance from a scientific perspective. The incorporation of motivational tactics is a commendable approach. In addition, the iterative nature of the framework allows for reviews and improvements to be done over time. Further to this, OCDF recognises the customer (learners) as stakeholders and elicits feedback from the learners subsequently incorporating these findings in the next versions of the course."*

When asking questions regarding the ineffectiveness of the framework there was no indication that there was anything that would stop the framework from being useful. There was a suggestion that, from the standpoint of the OVRD course outline, to perhaps describe how the specific phases of development were derived from the OCDF. **NOR5:** *"Nothing to note as I think the OCDF will be able to assist educators with development, as to remind them what to consider when developing a course. I do have a suggestion, perhaps with the example Development course, show how you have gone through all the phases of development. You already have the end-product, which is good, but show how you got to that point by using the OCDF"*

Respondent **NOR9** also commented as an improvement the need to perhaps employ a validation process for each phase's deliverables. **NOR9:** *"The model could iterate within each phase or have some means of validating that the intended deliverables for each phase are appropriately addressed before proceeding to the next one."* The suggestion is a good suggestion as that would allow confirmation another check in the process for motivation and the ARCS-V model (Li & Keller, 2018).

An important factor that was raised when the respondents were asked what doesn't fit well within the framework. The following comment was made. "*It is not clear what the actions are taken on the feedback are. Perhaps a process is required to distil the feedback from the various stakeholders, thereafter, prioritize the feedback and incorporate useful changes. Stakeholders can also be requested. It is not clear how changes within the respective emergent technologies will be incorporated into the courses in a timely fashion. Considering that the realm of emergent technologies is fluid /dynamic how quickly will change within an emergent technology be incorporated in the course? Can the phases of the framework be executed quickly enough to keep up with changes in emergent technologies?"* The response leads to the finding that perhaps the core use of the framework needs to have an implementation tutorial as part of the framework since this would be slightly out of scope of the research. However, further research could be conducted in this regard as a way to improve on the framework by incorporating research on emerging technologies into a suggested re look at technology factors and how this could be incorporated in a quicker timeframe. These elements could be improved upon perhaps in a future version.

Further comments had no significant suggestions on ineffective aspects of the framework. One respondent commenting *"Nothing obvious jumps out at me. It seems well thought out and every step is there for a reason".*

Furthermore, the respondents were asked that If the OCDF were to be used, how they think that the course framework helps an educator to grab the learner's attention and keep them engaged. It was found that the respondents thought that the OCDF makes the educator think about each component of the course and rationalise it's use furthering engagement and learning elements through the use of adding ARCS-V. **SAF** *"It makes the educator think about every component that is included in the course. Makes them rationalise its use and effectiveness in achieving student engagement and learning."* One respondent saw a potential problem with using the framework in terms additional workload to the educator. **NOR9:** "*A positive aspect of the motivation framework in that there is a deliberate attempt to keeps students engaged. However, a limitation with this initiative is that it may add additional overhead to teaching staff. This may be overcome by though finding ingenious ways of learner engagement, possibly through the use of AI and digital bots, although this may take away the personal aspect of teacher to student relationship.*" This thinking could be attributed to the idea that by following a framework the educator cannot leave steps out or that it might feel too rigid.

When asking the respondents if the Online Course Development Framework could benefit educators, could be by educators to develop online courses for emergent technologies, could aid in better completion rates as well as enhance motivation, all the respondents replied with positive comments. Not one respondent thought that it could not be used for the reasons mentioned. What was also found is that the questions regarding if the OCDF could be used for non-emergent technology courses the respondents were also positive about the use. **NOR5:** *"Yes, this will definitely help the organisation. I would say that it would help the educators more than organisation, but this will overflow to an advantage to the organisation."*

The research found that the OCDF could be used as a useful online course development framework to develop courses for emerging technologies by using effective learning theories, instructional design methods and motivational models.

As identified as a risk in section 3.12, not all respondents participated in the second round of interviews due to the time constraints of this empirical research study. Although not all the respondents responded in the second round the respondents that did respond was extremely positive about the Online Course Development Framework. All the respondents would find it useful to use it at their organisation, and all of them think that it could aid the completion rates of learners. Furthermore, all the respondents thought that the OCDF could be used to develop online courses that would keep learners motivated.

Table 11. *When asking the respondents on the usefulnes of the OCDF in developing courses, and keeping learners motivated, all of the respondents found it useful and felt it will keep learners motivated.*

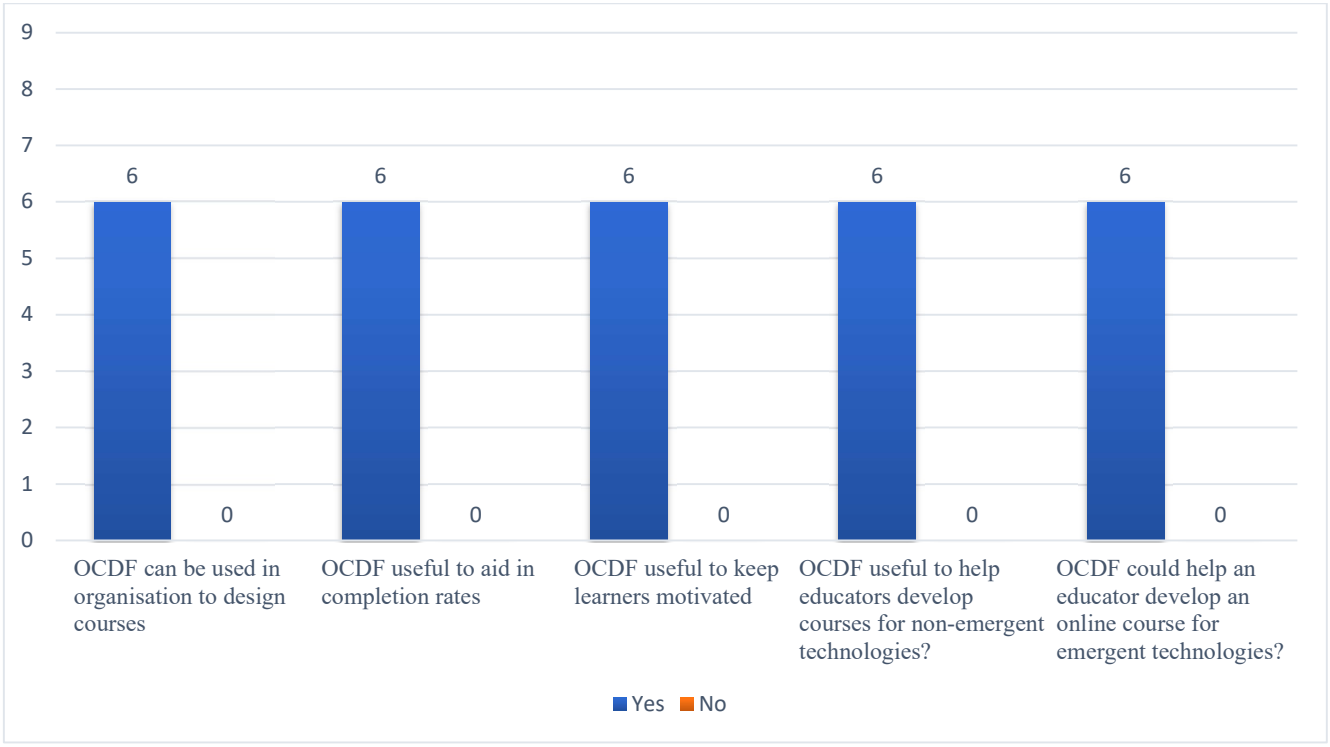


Table 12. *Research Questions: Summary of findings*

RQ1.1: Which learning theories could be used to construct a useful framework for developing online courses?	**Many theories such as behaviourism, cognitivism, connectivism and constructivism could be used to develop frameworks for online courses, but the choice of theory is dependent on the type of course that is to be developed. For example, for a language course, behaviourism would be an appropriate learning theory to use. However, for a programming or creative course constructivism is a very useful learning theory to follow as it promotes creative thinking**
RQ1.2: Could any of these theories be used to develop courses in emerging technologies such as an Online Virtual Reality Development course?	Yes. Constructivism can be used as a useful learning theory for an Online Virtual Reality Development course. Constructivism is well suited where emphasis is placed on learning from and adding onto prior knowledge to construct new knowledge. Thus, all knowledge from various areas plays a role in the learning. Social aspects of learning also play an important role in constructivism and this factor makes it an excellent theory to use in courses that want to include social elements.

RQ1.3: What methods or models could be used to construct a framework for the development of online courses?	To develop the framework the ADDIE Instructional Design model was used, in combination with the ARCS-V motivational model to guide the creation of motivational elements within the framework. Bloom's Taxonomy was used to guide the levels of learning within the activities.
RQ1.4: How can the framework be used to develop an emerging technologies course sus as an Online *Virtual Reality Development course?*	Using the research findings and incorporating the learning theory from RQ 1.1 as well as 1.2 and using the models and methods discovered in RQ 1.3 a successful course could be developed by using the framework. This is backed up by the initial research findings
RQ1: Could an Online Course Development Framework be created that could aid educators in developing online course for emerging technologies?	It was found that by applying the theories, methods and models derived from the research findings, that an Online Course Development Framework was created that can be used in the development of an online course for emerging technologies.

.

6 CONCLUSION AND FUTURE RESEARCH

6.1 Conclusion

On the outset of this research study, the aim was to discover if a useful Online Course Development Framework (OCDF) could be developed that can support educators in the development of online courses for emerging technologies.

Through the literature review it was discovered that learning theories could play a significant guiding role in the development of online courses. However, the study found that educators don't explicitly use learning theories when developing courses and that this was attributed to educators having experience in course design and having a 'feel' for what works and what does not. This study found that constructivism is well suited for emerging technology courses such as Virtual Reality development, because of the nature of building on previous knowledge and putting the learner at the centre of the learning experience.

The ADDIE instructional design model was found to be relevant and well suited for online course development. Furthermore, it was found that educators do not use motivational models in their course design, but that they once again

use the experience to guide which aspects would guide learners and keep them motivated. This research found that the ARCS-V motivational design model is an excellent model to use as a guiding model for designing motivational elements into a course. This was especially valid and useful when using motivational elements at each stage of the ADDIE design process, as this could be used as a check to add attention, relevance, confidence and volition driving activities and content to the OCDF. Through this research it was discovered that Bloom's taxonomy was useful in guiding learning outcomes. Therefore, educators used Bloom's quite extensively when developing courses and often used, perhaps mistakenly, as an instructional design model. In conclusion, the framework was developed by discovering what learning theories were useful, as well as which models and methods could be used, implementing it in the form of a framework and testing it by developing a test course outline for Virtual Reality Development.

The OCDF combined the ARCS-V motivational model and Blooms taxonomy with the ADDIE model to develop an OCDF that can help guide educators include constructivist principles, motivational elements and verify the levels of learning when creating an online course for emerging technologies. When gathering feedback from educators on the validity of this proposed framework, the OCDF proved to be successful in providing a useful and relevant tool to support educators in developing online courses, not only for emerging technologies but also online courses in general.

6.2 Future research

Potential future research could be conducted in the effectiveness of using the Online Course Development Framework (OCDF) to test other courses developed with the framework such as the Internet of Things, Augmented Reality etc. The OCDF was developed with creating online courses for emerging technologies in mind. The framework was tested with a Virtual Reality Development course outline but was not yet tested with other emerging technologies.

Other future research could explore concepts of using connectivism theory with Artificial Intelligence to be used in the OCDF.

Research in the field of Brain Compatible Learning Principles and combining or using it with the OCDF could provide further insights into advancements in course design and development.

7 REFERENCES

Abdul Ghani, M. T., & Wan Daud, W. A. A. (2018). Adaptation of Addie Instructional Model in Developing Educational Website for Language. *Global Journal of Al-Thafaqaf*, *8*(2), 7–16.

Agarwal, P. K. (2019). Retrieval practice & Bloom's taxonomy: Do students need fact knowledge before higher order learning? *Journal of Educational Psychology*, *111*(2), 189–209. https://doi.org/10.1037/edu0000282

Alnajdi, S. M. (2018). The Effectiveness of Designing and Using a Practical Interactive Lesson based on ADDIE Model to Enhance Students' Learning Performances in University of Tabuk. *Journal of Education and Learning*, *7*(6), 212. https://doi.org/10.5539/jel.v7n6p212

Amineh, R., & Asl, H. (2015). Journal of Social Sciences, Literature and Languages Review of Constructivism and Social Constructivism. *©2015 JSSLL Journal*, *1*(1), 9–16.

Arghode, V., Brieger, E. W., & McLean, G. N. (2017). Adult learning theories: implications for online instruction. *European Journal of Training and Development*, *41*(7), 593–609. https://doi.org/10.1108/EJTD-02-2017-0014

Bada, S. O. (2015). The psychogenisis of knowledge and its epistemological significance. *IOSR Journal of Research & Method in Education*, *5*(6), 66–70. https://doi.org/10.9790/7388-05616670

Bair, R. A., & Stafford, T. (2016). Connected and Ubiquitous: a Discussion of Two Theories That Impact Future Learning Applications. *TechTrends*, *60*(2), 129–135. https://doi.org/10.1007/s11528-016-0021-z

Baldwin, S. J., & Ching, Y.-H. (2019). An online course design checklist: development and users' perceptions. *Journal of Computing in Higher Education*, *31*(1), 156–172. https://doi.org/10.1007/s12528-018-9199-8

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain. *Journal of Systems and Software*, *80*(4), 571–583. https://doi.org/10.1016/j.jss.2006.07.009

Budoya, C. M., Kissake, M. M., & Mtebe, J. S. (2019). Instructional design enabled Agile Method using ADDIE Model and Feature Driven Development method. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *15*(1), 35–54.

Cardoza, C. (2018). Gartner's top 10 technology trends for 2019 - SD Times. Retrieved May 8, 2019, from https://sdtimes.com/softwaredev/gartners-top-10-technology-trends-for-2019/

Cearley, D., & Burke, B. (2018). Top 10 Strategic Technology Trends for 2019. *Gartner*, (October 2018), 46.

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. SAGE Publications Ltd.

Cheung, L. (2016). Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation. *Journal of Biomedical Education*, *2016*, 1–6. https://doi.org/10.1155/2016/9502572

Christian Misobi Budoya, Mussa M. Kissaka, J. S. M. (2019). Instructional design enabled Agile Method using ADDIE Model and Feature Driven Development method. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *15*(1), 35–54.

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist*, *26*(2), 120–123.

Cohen, D., & Crabtree, B. (2006). Qualitative Research Guidelines Project. *Robert Wood Johnson Foundation*, 2.

Constancio, F. G., Maria F. K. B., C., Danielle X. P., N., Joao Paulo C. L., da C., Zanatta, M. D. R., Sousa, R. T. de, … Mota, N. T. da. (2018). Extended ADDIE Model for improved Distance Learning Courses. *2018 IEEE Frontiers in Education Conference (FIE)*, *2018-Octob*(1), 1–5. https://doi.org/10.1109/FIE.2018.8658925

Costello, K. (2019). Gartner Top Technologies and Trends Driving the Digital Workplace. Retrieved May 9, 2019, from https://www.gartner.com/smarterwithgartner/top-10-technologies-driving-the-digital-workplace/

Czerkawski, B. C., & Lyman, E. W. (2016). An Instructional Design Framework for Fostering Student Engagement in Online Learning Environments. *TechTrends*, *60*(6), 532–539. https://doi.org/10.1007/s11528-016-0110-z

Davis, J. (2019). Adult Learning with Education. Retrieved from http://juliandavis.com/usmx-ldt100x/learning-theory-chart/

Do, H. (2018). *Critical thinking and transformative learning*. *22*(1), 103–114.

Du Boulay, B., & Del Soldato, T. (2016). Implementation of Motivational Tactics in Tutoring Systems: 20 years on. *International Journal of Artificial Intelligence in Education*, *26*(1), 170–182. https://doi.org/10.1007/s40593-015-0052-1

Dumford, A. D., & Miller, A. L. (2018). Online learning in higher education: exploring advantages and disadvantages for engagement. *Journal of Computing in Higher Education*, *30*(3), 452–465. https://doi.org/10.1007/s12528-018-9179-z

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Etikan, I. (2017). Sampling and Sampling Methods. *Biometrics & Biostatistics International Journal*, *5*(6), 5–7.

https://doi.org/10.15406/bbij.2017.05.00149

Facebook Technologies LLC. (2019). Oculus Quest | Oculus. Retrieved May 9, 2019, from https://www.oculus.com/quest/

Fraser, B. J., Tobin, K. G., & McRobbie, C. J. (2012). Second International Handbook of Science Education. *Second International Handbook of Science Education*, 1–1564. https://doi.org/10.1007/978-1-4020-9041-7

Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical Teacher*, *38*(10), 1064–1069. https://doi.org/10.3109/0142159X.2016.1173661

Harasim, L. (2017). Learning Theory and Online Technologies. In *American Journal of Distance Education* (Vol. 26). https://doi.org/10.4324/9781315716831

Hattie, J. (2015). The applicability of Visible Learning to higher education. *Scholarship of Teaching and Learning in Psychology*, *1*(1), 79–91. https://doi.org/10.1037/stl0000021

Hess, A. K. N., & Greer, K. (2016). Designing for engagement: Using the ADDIE model to integrate high-impact practices into an online information literacy course. *Communications in Information Literacy*, *10*(2), 264–282.

Hood Cattaneo, K. (2017). Telling Active Learning Pedagogies Apart: from theory to practice. *Journal of New Approaches in Educational Research*, *6*(2), 144–152. https://doi.org/10.7821/naer.2017.7.237

Horvitz, B. S., Beach, A. L., Anderson, M. L., & Xia, J. (2015). Examination of Faculty Self-efficacy Related to Online Teaching. *Innovative Higher Education*, *40*(4), 305–316. https://doi.org/10.1007/s10755-014-9316-1

Illeris, K. (2018). An overview of the history of learning theory. *European Journal of Education*, *53*(1), 86–101. https://doi.org/10.1111/ejed.12265

Jiang, Y. (2019). The Effective Application of Fragmented Learning Guided by Constructivism. *International Journal of Education, Culture and Society*, *3*(1), 10. https://doi.org/10.11648/j.ijecs.20180301.13

Johnston, E., Olivas, G., Steele, P., Smith, C., & Bailey, L. (2018). Exploring Pedagogical Foundations of Existing Virtual Reality Educational Applications: A Content Analysis Study. *Journal of Educational Technology Systems*, *46*(4), 414–439. https://doi.org/10.1177/0047239517745560

Jung, H., Kim, Y. R., & Lee, H. (2018). *Advanced Instructional Design for Successive E-Learning : Based on the Successive Approximation Model (SAM) Main Characteristics of SAM*. *18*, 1047–1056.

Juvova, A., Chudy, S., Neumeister, P., Plischke, J., & Kvintova, J. (2015). Reflection of Constructivist Theories in Current Educational Practice. *Universal Journal of Educational Research*, *3*(5), 345–349. https://doi.org/10.13189/ujer.2015.030506

Kathryn, A., Hess, N., & Greer, K. (2016). Designing for Engagement: Using the ADDIE Model to Integrate High-Impact Practices into an Online Information Literacy Course-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0). Designing for Engagement: Using the ADDIE Model to Integrate High-I. *Communications in Information Literacy*, *10*(2), 264–282. https://doi.org/10.15760/comminfolit.2016.10.2.27

Keller, J. M. (2010). Motivational Design for Learning and Performance. In *Motivational Design for Learning and Performance: The ARCS Model Approach*. https://doi.org/10.1007/978-1-4419-1250-3

Keller, J. M. (2016). Motivation, Learning, and Technology: Applying the ARCS-V Motivation Model. *Participatory Educational Research*, *3*(2), 1–15. https://doi.org/10.17275/per.16.06.3.2

Khalil, M. K., & Elkhider, I. A. (2016). Applying learning theories and instructional design models for effective instruction. *Advances in Physiology Education*, *40*(2), 147–156. https://doi.org/10.1152/advan.00138.2015

Khan, T., Johnston, K., & Ophoff, J. (2019). The Impact of an Augmented Reality Application on Learning Motivation of Students. *Advances in Human-Computer Interaction*, *2019*, 1–14. https://doi.org/10.1155/2019/7208494

Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses. *Computers & Education*, *104*, 18–33. https://doi.org/10.1016/j.compedu.2016.10.001

Kizito, R. (2016). Connectivism in Learning Activity Design: Implications for Pedagogically-Based Technology Adoption in African Higher Education Contexts. *International Review of Research in Open and Distance Learning*, *17*(2).

Kumi-Yeboah, A. (2018). Designing Cross-Cultural Collaborative Online Learning Framework for Online Instructors. *Online Learning*, *22*(4), 181–201. https://doi.org/10.24059/olj.v22i4.1520

La Pelle, N. (2004). Simplifying Qualitative Data Analysis Using General Purpose Software Tools. *Field Methods*, *16*(1), 85–108. https://doi.org/10.1177/1525822x03259227

Li, K., & Keller, J. M. (2018). Use of the ARCS model in education: A literature review. *Computers and Education*, *122*(May 2017), 54–62. https://doi.org/10.1016/j.compedu.2018.03.019

Liagkou, V., Salmas, D., & Stylios, C. (2019). Realizing Virtual Reality Learning Environment for Industry 4.0. *Procedia CIRP*, *79*, 712–717. https://doi.org/10.1016/j.procir.2019.02.025

Liu, R., & Chiang, Y.-L. (2019). Who is more motivated to learn? The roles of family background and teacher-student interaction in motivating student learning. *The Journal of Chinese Sociology*, *6*(1), 6. https://doi.org/10.1186/s40711-019-0095-z

Loorbach, N., Peters, O., Karreman, J., & Steehouder, M. (2015). Validation of the Instructional Materials

Motivation Survey (IMMS) in a self-directed instructional setting aimed at working with technology. *British Journal of Educational Technology*, *46*(1), 204–218. https://doi.org/10.1111/bjet.12138

Lub, V. (2015). Validity in Qualitative Evaluation. *International Journal of Qualitative Methods*, *14*(5), 160940691562140. https://doi.org/10.1177/1609406915621406

Ludlow, B. L. (2017). Virtual Reality: Emerging Applications and Future Directions. *Rural Special Education Quarterly*, *34*(3), 3–10. https://doi.org/10.1177/875687051503400302

McCaffrey, M. (2017). *Unreal Engine VR Cookbook: Developing Virtual Reality with UE4* (1st ed.). Addison-Wesley Professional PTG.

McIver, D., Fitzsimmons, S., & Flanagan, D. (2016). Instructional Design as Knowledge Management. *Journal of Management Education*, *40*(1), 47–75. https://doi.org/10.1177/1052562915587583

Meier, D. (2016). Situational Leadership Theory as a Foundation for a Blended Learning Framework. *Jouurnal of Education and Practice*, *7*(10), 25–30.

Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, *17*(1), 2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001

Nadiyah, R. S., & Faaizah, S. (2015). The Development of Online Project Based Collaborative Learning Using ADDIE Model. *Procedia - Social and Behavioral Sciences*, *195*, 1803–1812. https://doi.org/10.1016/j.sbspro.2015.06.392

Neuman, W. L. (2011). Social research methods: qualitative and quantitative approaches: Boston, [Mass.]: Pearson. In *(7Th, International Ed.)*.

Noble, S. (2019). The ultimate VR, AR and MR guide - virtual reality, augmented reality and mixed reality explained. Retrieved May 8, 2019, from https://www.aniwaa.com/guide/vr-ar/ultimate-vr-ar-mr-guide/

Noruzi, A. (2016). Impact factor, h-index, i10-index and i20-index of Webology. *Webology*, *13*(1), 1–4.

Obrist, V. U., & Martinez, E. A. (2015). Application of Virtual Reality in a Learning Experience. *Journal of Computer Science & Technology*, *15*(2), 149–153.

P. Libao, N. J., B. Sagun, J. J., Tamangan, E. A., P. Pattalitan, A., D. Dupa, M. E., & Bautista, R. G. (2016). Science learning motivation as correlate of students' academic performances. *Journal of Technology and Science Education*, *6*(3), 209. https://doi.org/10.3926/jotse.231

Pandit, N. R. (1996). The creation of theory: A practical examination of the grounded theory method. *The Qualitative Report*, *no. 327*(4), 1–19.

Panetta, K. (2018). Gartner Top 10 Strategic Technology Trends for 2019. Retrieved May 8, 2019, from https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2019/

Prashanti, E., & Kumar, K. (2016). Blended learning for reinforcing dental pharmacology in the clinical years: A qualitative analysis. Retrieved June 7, 2019, from Indian Pharmalogical Society website: http://www.ijp-online.com/article.asp?issn=0253-7613;year=2016;volume=48;issue=7;spage=25;epage=28;aulast=Eachempati#

Rahman, S. A., & Manaf, N. F. A. (2017). A Critical Analysis of Bloom's Taxonomy in Teaching Creative and Critical Thinking Skills in Malaysia through English Literature. *English Language Teaching*, *10*(9), 245. https://doi.org/10.5539/elt.v10n9p245

Reese, S. A. (2015). Online learning environments in higher education: Connectivism vs. dissociation. *Education and Information Technologies*, *20*(3), 579–588. https://doi.org/10.1007/s10639-013-9303-7

Robinson, J. M. (2018). Evaluation of Teaching Methods to Improve Reading Performance of English Language Learners. *Journal for the Advancement of Educational Research International*, *12*, 25–33.

Saari, A. (2019). Out of the box: behaviourism and the mangle of practice. *Discourse: Studies in the Cultural Politics of Education*, *40*(1), 109–121. https://doi.org/10.1080/01596306.2018.1549707

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2019). *Research Methods for Business Students Eighth Edition*.

Scoppio, G., & Luyt, I. (2017). Mind the gap: Enabling online faculty and instructional designers in mapping new models for quality online courses. *Education and Information Technologies*, *22*(3), 725–746. https://doi.org/10.1007/s10639-015-9452-y

Sedgwick, P. (2014). Cross sectional studies: Advantages and disadvantages. *BMJ (Online)*, *348*(March), 1–2. https://doi.org/10.1136/bmj.g2276

Stanny, C. (2016). Reevaluating Bloom's Taxonomy: What Measurable Verbs Can and Cannot Say about Student Learning. *Education Sciences*, *6*(4), 37. https://doi.org/10.3390/educsci6040037

Tan, C. (2017). Constructivism and pedagogical reform in China: issues and challenges. *Globalisation, Societies and Education*, *15*(2), 238–247. https://doi.org/10.1080/14767724.2015.1105737

Tracy, S. (2013). Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact. In *John Wiley & Sons, Ltd*. Wiley-Blackwell.

Trust, T., & Pektas, E. (2018). Using the ADDIE Model and Universal Design for Learning Principles to Develop an Open Online Course for Teacher Professional Development. *Journal of Digital Learning in Teacher Education*, *34*(4), 219–233. https://doi.org/10.1080/21532974.2018.1494521

Ucar, H. (2016). *Use of ARCS-V Motivational Design Model in Online Distance Education ARCS-V Motivational Design Model*. 55–60.

Urquhart, C., Lehmann, H., & Myers, M. D. (2010). Putting the "theory" back into grounded theory: Guidelines

for grounded theory studies in information systems. *Information Systems Journal*, *20*(4), 357–381. https://doi.org/10.1111/j.1365-2575.2009.00328.x

Usher, W., Edwards, A., & de Meyrick, B. (2015). Utilizing educational theoretical models to support effective physical education pedagogy. *Cogent Education*, *2*(1). https://doi.org/10.1080/2331186X.2015.1094847

van Niekerk, J., & Webb, P. (2016). The effectiveness of brain-compatible blended learning material in the teaching of programming logic. *Computers and Education*, *103*, 16–27. https://doi.org/10.1016/j.compedu.2016.09.008

Veletsianos, G. (2016). *Emergence and innovation in digital learning*.

Yan, K. (2017). *A Comparison Between Two Leading Linguistic Figures: Bloomfield and Firth*. *72*(Icmess), 461–464. https://doi.org/10.2991/icmess-17.2017.108

Yarbrough, J. R. (2018). Adapting adult learning theory to support innovative, advanced, online learning-WVMD Model. *Research in Higher Education Journal*, *35*, 1–15.

Yilmaz, T. K., & Cagiltay, K. (2016). Designing and Developing Game-Like Learning Experience in Virtual Worlds: Challenges and Design Decisions of Novice Instructional Designers. *Contemporary Educational Technology*, *7*(3), 206–222.

Yumurtaci, O. (2017). A re-evaluation of mobile communication technology: A theoretical approach for technology evaluation in contemporary digital learning. *Turkish Online Journal of Distance Education*, *18*(1), 213–223.

8 APPENDICES

8.1 Appendix A: Research Instrument

Research Questions (Pre-Framework)

Questions relating to respondent's role and experience:

1.) What is your role at your organisation?
2.) How long have you been in your current role?
3.) How many years of experience have you had in the educational sector?
4.) How many years of experience have you had in Online Education specifically?
5.) What experience have you had in either designing, developing, teaching or administering online courses?
6.) How many online courses does your organisation provide?
7.) How many students enrol on average in an online course (Lowest and highest or on average)

Questions relating to course design:

8.) What does a course framework (Course outline) need to include in your opinion?
9.) When developing a course framework, what aspects or factors do you feel as very important?
10.) What process do you follow when designing a course?
11.) When designing courses, do you follow any learning theories?
12.) If you answered yes to the above question, which theories do you follow?
13.) If you have applied a learning theory to your development, on a scale of 1-5, 1 being not at all and 5 being extremely close, how close do you follow it?
14.) Why do you follow the learning theory as closely or not as closely?
15.) Have you heard of the ADDIE Instructional Design model?
16.) Have you used the ADDIE Instructional Design Model?
17.) Have you heard of the ARCS motivational design model?
18.) Have you used the ARCS motivational design model?
19.) Has your organisation considered an Online or Classroom Based Virtual Reality Development course?
20.) Referring to question 19. Why / why not?
21.) What do you feel would be the most important aspect of delivering an Online Virtual Reality Development course?
22.) What market research do you do before developing a course and course framework?
23.) Do you use existing material or develop your own material from scratch?
24.) How do you define your learning strategies of the course?
25.) How do you motivate students and keep that motivation momentum going?

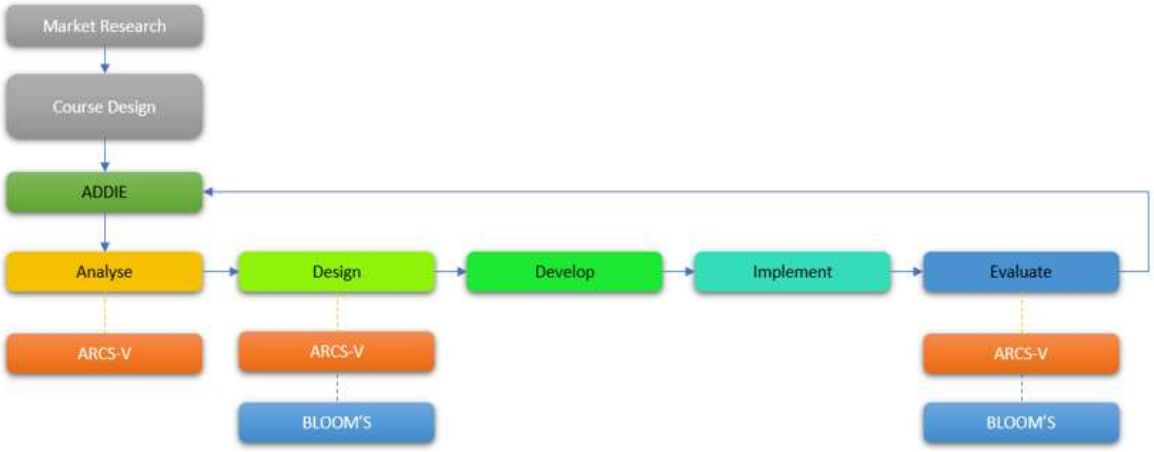
Research Questions (Post Framework):

1.) When looking at the Online Course Development Framework (OCDF) and the Online Virtual Reality Development course outline, what do you find effective in this framework?
2.) What do you find ineffective in the OCDF?
3.) The OCDF was developed following the Constructivism theory (Constructing own knowledge and learning by building on previous knowledge) and ARCS-V motivational model and using Blooms' Taxonomy to aid in the course design to align motivational aspects into the framework, as well as create assessments that covers levels of complexity and progression – How well do you think it fits with the Online Virtual Reality Development course outline?
4.) What fits well with regards to the framework?
5.) What doesn't fit well within the framework?
6.) Do you think that the OCDF could help an educator develop an online course for emergent technologies (VR, AR, MR, IoT, AI, Robotics, New Advanced Real Time rendering etc)?
7.) How do you think that the OCDF can help an educator develop an online course for emergent technologies?
8.) Do you think it could help educators develop courses for non-emergent technologies?
9.) How do you think that the current framework could provide motivation for a student to continue studying?
10.) If the OCDF is used as a guide, how do you think that the course framework helps aid the educator to grab the learner's attention and keep them engaged?
11.) What do you think are the positive aspects and negative aspects of the OCDF regarding overall motivational aspects?
12.) How do you think the framework helps provide attention?
13.) How do you think the framework helps provide relevance to the online course?
14.) How do you think the framework provides the ability to build confidence generating aspects to the online course?
15.) How do you think the framework provides the ability to build satisfaction generating features into the online course?
16.) Do you think that the framework could be useful in designing a course that aids in completion rates of courses by learners?
17.) When looking at the OCDF do you think it could be useful to some degree in your organisation if you were to use it for online course development in part or as a whole?

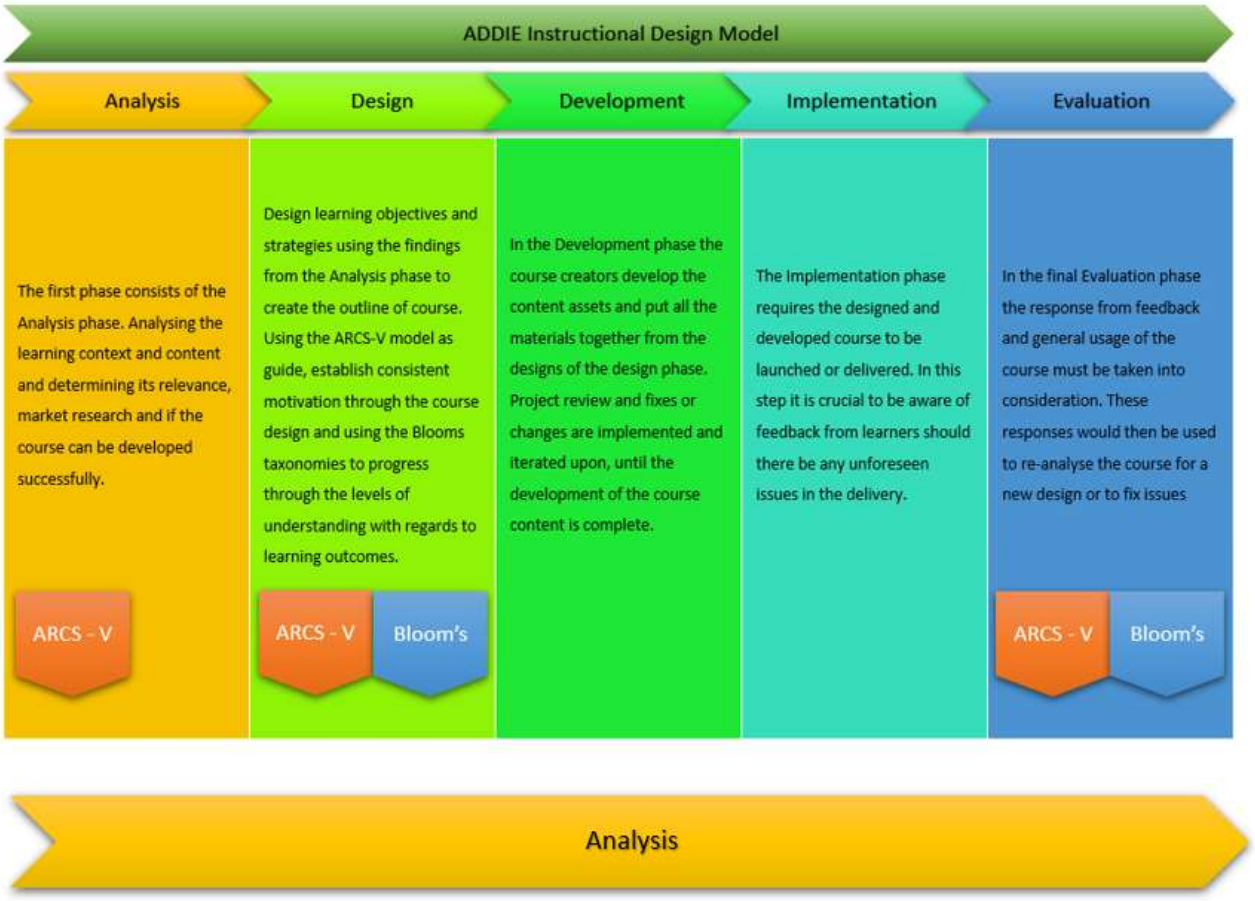
8.2 Appendix B: Online Course Development Framework

An Online Course Development Framework

Adapted ADDIE Instructional Design Model implementing ARCS-V Motivational Design Model and Bloom's Taxonomy.



ADDIE Instructional Design Model includding depiction of where ARCS-V and Bloom's Taxonomy could be used to enhance learning motivation and evaluate learning objectives.



In the analysis phase the educator analyses the needs of the learners by looking at the educational objectives of the course and designing the outcomes to align to the educational goals. Use ARCS-V motivational model to guide the motivational aspects of the course analysis.

In the analysis phase:

- Consider the relevance of the course (Which technologies or concepts will be delivered online).
- Conduct market research (Look at what others are doing, what is relevant to the industry or field).
- Consider the target audience and pre-requisites (Age group, education level, duration of course).
- Consider the admission requirements.
- Consider what the career possibilities are.
- What level is the course (Credits and qualifications).
- Identify and speak to Industry experts.
- Identify if course needs to be taught in various languages.
- Identify and consider how subject matter experts can aid in course design.
- Look at research conducted in the field to be up to date with content and findings.
- Decide if additional learning experts and content developers are needed.
- Decide on final course learner outcomes. (Purpose of course)
- Gather the possible Learning Objectives of the course.
- Consider the weight of modules/Lesson and assessment criteria.
- List motivational design goals
- Brainstorm list of ARCS-V tactics

Resources:

Market research

https://www.linkedin.com/learning/learning-design-research/market-research?u=43268076

Writing Measurable Learning Outcomes

http://www.celt.iastate.edu/teaching/preparing-to-teach/tips-on-writing-course-goalslearning-outcomes-and-measureable-learning-objectives/

In the Design phase, educators need to develop the learning activities, assessment, and methods of delivery. In addition, they should develop the strategies on how to present the course material.

When designing the course, a learning theory and philosophy can be considered. Constructivism theory fits well for technologies such as VR, AI, Robotics, Game Development, 3D Design since it encourages active learning. Choosing a fitting learning theory will enable the educator to decide which types of learning activities and assessments to create. The Design phase should be developed by building in learner motivation by using the **ARCS-V** model. By using the ARCS-V elements (Attention, Relevance, Confidence, Volition) as guide to see if each element of the course contains one of these aspects and all aspects in each module or lesson if possible. **Bloom's Taxonomy** should be used to design the learning objectives using **ARCS-V** to once again guide the motivational aspects of the course design.

ARCS-V

ARCS - V

Using the ARCS-V motivational learning model in the Design phase of the ADDIE Instructional Design model.

ATTENTION	RELEVANCE	CONFIDENCE	SATISFACTION	VOLITION
Capture the interest of learners and stimulate the curiosity to learn. **Questions to ask:** Are the learners going to be interested? What tactics will stimulate their curiosity and interest? **Learning content and activities that can enforce Attention:** Story. Personalisation. Discussions. Gamification. Game-based learning. Humor. Interesting, or thought provoking content. Realtime or video. List of interesting uses and applications for course topics. Include social elements. Group activities. Research elements. Participation activities.	Meet the personal needs/ goals of the learner to effect a positive attitude. **Questions to ask:** Will learners believe it is valuable? What can I do to help them believe it is important? **Learning content and activities that can enforce Relevance:** Personalisation. Clearly established Learning Objectives. Assesments. Show industry related and up to date content. Case Studies. Chat with industry experts (Online Guest Lecture). Possibly invole potential recruiters. Research elements.	Establish clear criteria for success. Reinforce confidence in the learner by building positive expectancies and experiences of success. **Questions to ask:** Will the learners feel confident about their ability to learn this? What do I need to do to help them be confident? **Learning content and activities that can enforce Confidence:** Create clear learner objectives. Clear instruction on LMS and tools as well as help contact points. Gamification. Game-based learning. Solicit feedback. Show interest from a educator perspective. Self-paced deadlines. Reassure learner of continued success. Always respond to learner. Frequent Feedback.	Reinforce accomplishment with internal and external rewards. **Questions to ask:** What can I do to help the learners feel good about their experience and desire to continue learning? **Learning content and activities that can enforce Satisfaction:** Case Studies. Personalisation. Discussions. Gamification Game-based learning. Congratulate the learner on getting this far. Well developed activities that are suitably challenging makes the learner think. Include social elements Group activities. Research elements. Frequent Feedback.	Reinforce the commitment to learn and complete the course. **Questions to ask:** What can I do to help the learners maintain their goal orientation and task-focus throughout this learning event? **Learning content and activities that can enforce Volition:** Time Schedule.Clear timelines and deadlines. Personalisation. Promote the development and use use of good study plan. Gamification and game-based learning. Clearly established Learning Objectives. Reassure learner of continued success. Include social elements.

In the Design phase:

- Decide on technology requirements, platforms, systems – for course delivery, facilitation and student to participate.
- Consider user experience and accessibility options.
- Consider bandwidth requirements.
- Consider if any changes and fixes be easy or difficult to make and how it will be managed.
- Look at what is pedagogically important to the course.
- Design learning activities by using motivational aspects in learning. (Use **ARCS-V** to guide the motivational design).
- Design learning objectives and assessment methods using **Bloom's Taxonomy**. (Planning verbs)
- Tie down the Learning Objectives of the course and of each Module / Lesson
    - Use **Bloom's Taxonomy** to make sure the thinking level and progression is on the correct level.
    - Use **Bloom's Taxonomy** when creating activities and assessment.
- Match the learning activities and assessment to the way they will be delivered in the development phase.
- Create clear evaluation criteria and make it available to learner if applicable
- Consider designing interactive content **(Attention, Satisfaction, Relevance)**
- Create video to grab learner's attention but don't create too lengthy videos. **(Attention)**
- Include examples of how the learning examples/content might be useful to the learner now and in the future. **(Relevance)**
- Show how the learning activity is aligned to the learners learning objectives. **(Relevance, Satisfaction)**
- Provide frequent feedback (Confidence, Satisfaction)
- Design the weight of modules/Lesson and assessment criteria.
- Design appropriate assessments **(Relevance, Confidence, Satisfaction)**
- Consider Game-based learning.
- Gamified approaches to learning and/or content. **(Attention, Confidence, Satisfaction, Volition)**
- Make sure the learning activities are using multiple methods of learning if possible.
- Carefully reflect on the learning objectives from the learner's perspective and align the learning activities to them.
- Consider the overall challenge level appropriate for the learner audience.
- Make clear where grades can be accessed and how long it will take for grades to be available.

Resources:

Different Learning Theories
https://www.learning-theories.com/

ARCS-V Motivational Design Model
https://www.springer.com/gp/book/9781441912497

Designing learning objectives for new courses
https://www.linkedin.com/learning/teaching-techniques-writing-effective-learning-objectives/create-learning-objectives-for-new-courses?u=43268076

Learning Strategy best Technologies
https://elearningindustry.com/learning-strategy-best-technologies

Gamification Trends
https://elearningindustry.com/gamification-trends-2019-tips-ideas-packed

Emerging Technology Trends In eLearning
https://elearningindustry.com/technology-trends-changing-elearning-6-emerging

Bloom's Taxonomy Cheat Sheet
http://bloomstaxonomy.org/Blooms%20Taxonomy%20questions.pdf

Blooms Taxonomy (Checklist)

Remember	Understand	Apply	Analyze	Evaluate	Create
recognizing (identifying)	interpreting (clarifying, paraphrasing, representing, translating)	executing (carrying out)	differentiating (discriminating, distinguishing, focusing, selecting)	checking (coordinating, detecting, monitoring, testing)	generating (hypothesizing)
recalling (retrieving)	exemplifying (illustrating, instantiating)	implementing (using)	organizing (finding, coherence, integrating, outlining, parsing, structuring)	critiquing (judging)	planning (designing)
	classifying (categorizing, subsuming)		attributing (deconstructing)		producing (construct)
	summarizing (abstracting, generalizing)				
	inferring (concluding, extrapolating, interpolating, predicting)				
	comparing (contrasting, mapping, matching)				
	explaining (constructing models)				

In the Development phase the educator analyses the needs of the learners by looking at the educational objectives of the course and designing the outcomes to align to the educational goals. Develop activities and content that will help the learner improve performance.

In the Development phase:

- Develop the activities and content – consider how it will integrate with the Learner Management System.
- Develop content and consider User Interface and Accessibility options. (Test with Screen Readers such as NVA)
- Consider providing videos in alternative formats.
- Provide closed captions or transcriptions for video.
- It is advisable to open links in new windows or tabs.
- Consider readability fonts and styles.
- Ensure that the interface and areas of student activity is clean and clear.
- When developing content consider the tone, readability and context of the writing style.
- Develop interactive content.
- Set up / Develop social interaction areas.
- Consider backup solutions.
- Consider learner progression (Can the student go back and easily see where they last left off?)
- Ensure that progress can be tracked, and activities can be bookmarked.
- Test Learner management System, activities, content, assessments on various browsers, operating systems and computing devices.
- If there are any plug-ins needed provide clear links and instructions.
- If large files need to be accessed and downloaded, clearly display the file sizes.
- If learners need to deliver assignments make sure the size constraint is set and specified, and what format it needs to be. (Zip, PDF, Word, BMP, JPG etc.)

Resources

NVA Screen Reader
https://www.nvaccess.org/download/

Create Closed Captions
https://www.closedcaptioncreator.com/

Video Transcoding
https://coconut.co/video-transcoding

Implementation

In the Implementation phase the learning material and activities are put into practice and the learners are given access to the course. This phase is an active involvement phase and the educator should be well prepared to deal with learner questions and issues. Using ARCS-V to check if initial analysis is correct. Use Bloom's taxonomy to check if learning outcomes and objectives is still in line with data from the Evaluation phase.

In the Implementation phase:

- Test all aspects thoroughly.
- Provide access to Learner Management System.
- Provide easy registration.
- Make contact with the learner after signing / sign on. (Welcome email / message)
- Monitor server and delivery mechanisms (is it fast, does resources need to be increased)

Evaluation

In the Evaluation phase the educator can assess if the course was successful and effective. It also identifies if there are any issues present and if any aspects of the course can be improved upon. The results will then go through the Analysis, Design, Development and Implementation steps iteratively as it improves the course. Uses ARCS-V to check motivational elements. Use Bloom's Taxonomy to check learning levels to anal

In the Evaluation phase:

- Look at ways to continually enhance the course.
- Look at survey data to evaluate learner experience.
- Look at relevancy and if course is still up to date.
- Consider scalability.
- Plan for updates and upgrades as well as maintenance.
- Collect data on learner engagement and activity (Did learners' access and start the course, where are they spending the most time and the least time)
- Collect feedback from learners (Survey / Polls) to determine satisfaction and performance of the course.

8.3 Appendix C: Online Virtual Reality Development course outline

Course Description

Online Virtual Reality Development course.

By using the Online Course Development Framework the following Online Virtual Reality Development course outline was derived.

In the blue block it shows the Bloom's Taxonomy levels for each part of the Learning Outcomes.

In the orange blocks it shows the ARCS-V criteria for each of the chosen activities, assessments and course content.

Course Description

Online Virtual Reality Development course.

Course Scope

- **Credits:** 60
- **Course Length:** 18 weeks
- **Course Description** In the Virtual Reality development course the student will learn how to develop Virtual Reality experiences and applications such as games using industry accepted methods and tools that are well suited to the Virtual Reality platform.
- **Prerequisites:** None

Equipment Requirements

- **Required Hardware:** VR Device (Oculus Rift S, Oculus Quest, HTC Vive, MS Hololens 2) Windows 10 PC/Laptop with dedicated GPU. (Nvidia 1060Gtx and upward)
- **Required Software:** Unreal Engine 4 Autodesk Maya (Acquiring and Installation will be covered in the course)
- **Recommended Software:** Adobe Creative Suite
- **Other Requirements:** Stable Internet Connection Office tools (MS Office, Open Office)

Syllabus

- **Understanding Virtual Reality: Interface, Application, and Design,** *W.R. Sherman* and *A.B. Craig*, Elsevier; 2nd edition (2018), ISBN: 978-0128183991

Unreal Engine VR Cookbook: Developing Virtual Reality with UE4, *Mitch McCaffrey*, Addison Wesley Professional; 1st edition (2017), ISBN: 978-0134649177

The VR Book - Human-Centered Design for Virtual Reality, *Jason Jerald*, Morgan & Claypool Publishers; 1st edition (2015), ISBN: 978-1970001129

Course Topics

- VR Foundations
- Real-Time Rendering
- Unreal Engine Foundations
- Unreal Engine Blueprints
- Unreal Engine, Lighting, Particles Physics and Animation
- Unreal and VR
- VR Locomotion
- VR Optimization
- Final Project

Introduction Module

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS — Learning Outcomes

Remember Understand	**Have knowledge of:** How to navigate the learner management system and course content.
Remember Understand	**Have knowledge of**: Where to find social activities, teacher, support and fellow students.
Remember Understand	**Know** what to expect from the Online VR Development course.

ARCS-V — Resources

A | R | C | V	Course Outline and course timelines.
A | R | V	Introduction Video to course
S | V	Introduce the LMS (Show areas and where to access areas).
C | S	Links to help: Tutor emails, support FAQ's etc.
A | S	Forum
A | S | V	Instant Messaging servers and groups (Discord)

ARCS-V — Activities

A | C | S | V	Social Media chat: Sign up to Discord. (Follow invitation link) "Introduce yourself"
A | R | C	Forum discussion: Make a forum post about Learning goals.
R | V	Forum post (Upload activity)"Post an image that motivates you."

ARCS-V — Assessments

C	Multiple choice questions on LMS, Discord, Forum, help locations and timelines. (0% - Pass to continue. Multiple tries allowed)

Module 1: VR Foundations

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS — Learning Outcomes

Remember Understand	**Have knowledge of** VR Hardware, insight into Head Mounted Displays, stereoscopic displays, tracking and inertial measurement concepts
Analyse Evaluate	**Have knowledge of and can analyse and evaluate the** different hardware components in VR devices, VR hardware choices, target audience a
Understand	Have a clear understanding of the software components that a VR experience consists of.

ARCS-V — Resources

A | R | V	Introduction to VR concepts Video, what is possible and different hardware.
R | C | S	Written course Material giving more details about hardware rendering capabilities, and software API's and middleware
R | C | V	Links to technical specs and VR API's
R | C	Links to Textbooks

ARCS-V — Activities

A | R | C	Forum Discussion What hardware choice and why
A | C | V	Active Discord discussions about VR hardware with Tutor/Teacher

ARCS-V — Assessments

R | C | V	Online Test: Hardware and Software. Assessed by LMS (5%)

Module 2: Real-Time Rendering

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS — Learning Outcomes

Understand
Have knowledge of:
Game Engines, and game engine components

Evaluate
Apply
Can evaluate and apply knowledge of:
Tools and concepts for real-time rendering

Create
Can create an asset for real-time use. Content creation, content design methodologies.

ARCS-V — Resources

A | R | V — Video On skills with tools and concepts for real-time rendering.

A | R | V — Video on collaboration with interdisciplinary design teams using Game Engines.

R | C | S — Written course material:
Production pipelines and content creation workflows for developing interactive applications and implementing assets in a 3D production

A | R | V — Further Videos: In depth creation instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V — Activities

A | R | C — Installation and setup of 3D and 2D applications.

A | R | C | S — Develop a low polygonal asset for real time use

R — Hands-On activity: Export to various formats

A | R | C | V — Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (Recorded for upload)

ARCS-V — Assessments

R | C | V — **Online Test:**
Questions on Real time rendering of assets, game engines and game components Assessed by LMS (5%)

Module 3: Unreal Engine Foundations

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS — Learning Outcomes

Remember
Understand
Have knowledge of Unreal Engine 4 (UE4) capabilities and be able to evaluate the practical use. Builds towards Final Project in showing capabilities and potential use cases.

Apply
Create
Understanding of Editor, UI and Components and be able to use it in importing and manipulating 3D assets. This elements aid in the familiarization of the aspects of UE4

Analyse
Create
Gain solid practical skills in Unreal Editor by applying different properties and attributes. Builds towards Final Project in teaching how properties apply to assets and engine.

ARCS-V — Resources

A | R | V — Video on Unreal Engine capabilities.

A | R | V — Video On using Unreal Editor

R | C — Written course material:
Unreal Editor usage and components.

A | R | V — Further Videos: In depth creation instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V — Activities

A | R | C — Forum Posts on what features learner discovered that is most useful

A | R | C | S — Find examples of Unreal Developed VR. Post in Forum.

A | R | C | S — Find videos of 3 different unreal engine VR games and post in forum.

A | R | C | V — Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (Recorded for upload)

ARCS-V — Assessments

A | R | C | S | V — **Written Assignment**: Now that the student has an idea of capabilities write about a VR project that you want to build in the final delivery. Assessed by tutor Teacher (5%)

R | C | V — **Online Test:**
Questions on Unreal Engine and Unreal Editor and components Assessed by LMS (5%)

Module 4: Unreal Engine Blueprints

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V A = Attention R = Relevance C = Confidence S = Satisfaction V = Volition

BLOOMS
Remember
Understand
Apply
Analyse
Evaluate
Apply
Analyse
Evaluate
Create

Learning Outcomes

Have knowledge of Unreal Engine Blueprint capabilities and usage.

Understanding of Visual Programming, data types, and flow control. This aids in the understanding of coding interactivity in final project.

Gain solid practical skills in using Unreal Engine Blueprints to code interactive elements.

ARCS-V

Resources

A | R | V — Video on Unreal Engine Blueprints

A | R | V — Video On using Unreal Blueprints

R | C | S — Written course material: Unreal Blueprints, concepts and usages

A| R | V — Further Videos: In depth creation instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V
A | R | C | S | V
A | R | C | S | V
A | R | C | V

Activities

Develop an environment consisting of an interactive idea that uses Blueprints

Peer evaluation: Evaluation of peer projects (Interactive Environments)

Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (Recorded for upload)

ARCS-V
A | R | C | S | V
R | C | V

Assessments

Project Delivery:
Learner to build an environment consisting of specific criteria. Interactive elements and using specific Blueprints. Assessed by Tutor/Teacher (5%)

Online Test:
Questions on Unreal Engine Blueprints and programming principles. Assessed by LMS (5%)

Module 5: Unreal Engine Lighting, Particles Physics and Animation

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V A = Attention R = Relevance C = Confidence S = Satisfaction V = Volition

BLOOMS
Understand
Evaluate
Apply
Analyse
Evaluate
Create

Learning Outcomes

Have solid understanding of Unreal Engine's lighting, particles and physics and how to decide on different lighting techniques.

Solid practical skills in the use of lighting, particle effects, physics and animation. How to use it and implement it in combination in a single scene. Understanding how these aspects fit together contributes towards the final project.

ARCS-V

Resources

A | R | C | S | V — Videos: Videos on in depth concepts on Unreal engine. (Lighting, Particles, Physics and Animation).

R | C | S — Written course material: Written content on Unreal Engine in more technical detail. (Lighting, particles, Physics and Animation)

A | R | V — Further Videos: In depth instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V
A | R | C | S | V
A | R | C | S | V
A | R | C | V

Activities

Create a particle emitter that has physics properties and has interesting lighting applied.

Create a real-time animation.

Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (Recorded for upload)

ARCS-V
R | C | V

Assessments

Online Test:
Questions on Unreal Lighting, Physics, Particles and animation Assessed by LMS(5%)

Module 6: Unreal and VR

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V A = Attention R = Relevance C = Confidence S = Satisfaction V = Volition

BLOOMS	Learning Outcomes
Understand	**Have solid understanding of:** How To build VR interactivity into Unreal Engine
Apply Analyse Evaluate Create	**Solid practical skills in** building VR interactivity inside Unreal Engine. How interactivity is accomplished in VR with use of the UE4 engine is a primary skill the student will use in the final project.
Apply Analyse Evaluate Create	**Solid practical skills in** implementing VR with Unreal Engine

ARCS-V	Resources
A | R | C | S | V	Videos: How to implement VR in Unreal engine
R | C | S	Written course material: Written content on implementing VR in Unreal Engine
A | R | V	Further Videos: In depth instructor videos and How-To's
R | C	Links to further information and guides. Best practices etc.

ARCS-V	Activities
A | R | C | S | V	Create an interactive VR activity inside Unreal for viewing with VR headset.
A | R | C | S | V	Peer Review: Evaluate and consider peer learners' project deliverables.
A | R | C | V	Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (Recorded for upload)

ARCS-V	Assessments
A | R | C | S | V	**Project Delivery:** Create a new environment with VR interactivity, lighting, particles, physics. Assessed by Tutor/Teacher (5%)

Module 7: VR Locomotion

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V A = Attention R = Relevance C = Confidence S = Satisfaction V = Volition

BLOOMS	Learning Outcomes
Remember Understand	**Have solid understanding of** how to develop efficient movement and locomotion style in VR
Analyse Evaluate	**Solid practical skills in** taking the motion sickness and other issues into consideration when designing for motion. Locomotion is a crucial aspect in VR. The student will use locomotion implementation in the final project.
Apply Create	**Solid practical skills in:** Implementing locomotion systems in VR

ARCS-V	Resources
A | R | C | S | V	Videos: Locomotion considerations in VR
R | C | S	Written Course material: Written content on Locomotion options and industry implementations
A | R | V	Further Videos: In depth instructor videos and How-To's
R | C	Links to further information and guides. Best practices etc.

ARCS-V	Activities
A | R |	Forum Discussion on VR Locomotion issues.
A | R	Forum discussion: Brainstorm possible locomotion techniques

ARCS-V	Assessments
A | R | C | S | V	Deliver a project with good and bad locomotion aspects. Assessed by Tutor/Teacher (5%)

Module 7: VR Optimization

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS
Remember
Understand

Apply
Analyse
Evaluate
Create

Apply
Analyse
Evaluate
Create

Learning Outcomes

Have solid understanding of how to develop optimized code and assets for VR devices

Solid practical skills in developing optimized code and assets for VR.

Solid practical skills in: Implementing optimized code and assets for VR. An essential skill in any real-time application and especially true in VR, the student will use the skills learnt to deliver their final project.

ARCS-V
A | R | C | S | V

Resources

A | R | C | S | V — Videos:
Optimization of VR assets and code for VR.

R | C | S — Written course material:
Optimization of VR assets and code for VR.

A | R | V — Further Videos: In depth instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V
A | R | C | S | V

A | R | C | V

Activities

Create an optimized item for use in VR (item to be described)

Video stream, live Discord chat with Tutor. What went well, what went badly. Tutor discusses solutions (recorded for upload)

ARCS-V
A | R | C | S | V

Assessments

Project Delivery:
Use the item you created in your previous environment using the locomotion system. Assessed by Tutor/Teacher (5%)

R | C | V — Online Test:
Online test on VR Optimization methods and techniques. Assessed by LMS (5%)

Module 8: Final VR Course Project

BLOOMS' TAXONOMY : Remember | Understand | Apply | Analyse | Evaluate | Create

ARCS-V **A** = Attention **R** = Relevance **C** = Confidence **S** = Satisfaction **V** = Volition

BLOOMS
Remember
Understand

Apply
Analyse
Evaluate
Create

Learning Outcomes

Have solid understanding of:
How all elements integrate.

Solid practical skills in:
Developing a complete interactive application for distribution on target platform. Takin all the previously learnt skills into account the student will deliver a final project with the elements in place

ARCS-V
A | R | V

Resources

A | R | V — Videos:
Summary of all elements of course.

A | R | V — Video on exporting to VR

R | C | S — Written course material:
On exporting and pitfalls of various devices.

A | R | V — Further Videos: In depth instructor videos and How-To's

R | C — Links to further information and guides. Best practices etc.

ARCS-V
A | R | S | V

C | S | V

Activities

Design and outline your final project.

Tutor/Teacher approval of final project plan and deliverable

ARCS-V
A | R | C | S | V

Assessments

Project Delivery:
Final VR project deliverable.
Assessed by Tutor/Teacher (40%)