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Contact Address:
Prof. Dr. Aytekin İŞMAN
TOJNED, Editor in Chief
Sakarya-Turkey

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January 01, 2021
Prof. Dr. Aytekin ISMAN
Sakarya University

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Dr. Lory E. Haas
Sam Houston State University, Texas
loryhaas@shsu.edu

Dr. Elizabeth Lasley
Jefferson County Public School, Kentucky
Elizabeth.lasley2@jefferson.kyschools.us

ABSTRACT
There is extensive theoretical and practical research devoted to the purpose for implementing various pedagogies of engagement for student-centered learning. This article presents a phenomenological study of preservice teachers' cognitive and affective behavioral changes after participating in a semester-long project-based learning (PBL) experience. Forty-seven undergraduate education majors seeking certification in early childhood-6th-grade education who were enrolled in an early childhood education course participated in a PBL pedagogical approach to learning. Participants' shared their previous experiences with teaching and learning had been traditional approaches which were teacher-centered and teacher-directed. At the end of the semester and completion of their projects, students were asked to respond in writing to the following questions: Reflecting over the past semester, how do you think you have or have not changed from when you entered this course? Why do you think you have or have not changed? Responses to the questions revealed students were challenged by the student-centered approach to learning and preferred it versus traditional approaches. Findings of this phenomenological study illustrate the emergence of five themes based on students' perceptual changes after their semester-long experiences with PBL: autonomy, mastery, purpose, perspective taking, and evaluation. The themes align with the pedagogical principles of engagement identified in PBL and are consistent with skills needed for critical thinking and paradigm shifts in education to prepare individuals for advances in a global society.
Keywords: project-based learning, preservice teachers, autonomy, perspectives, pedagogy

INTRODUCTION

Twenty-first Century Pedagogy

"The last few decades have belonged to a certain kind of person with a certain kind of mind – computer programmers who could crank code, lawyers who could craft contracts, MBA's who could crunch numbers. But the keys to the kingdom are changing hands. The future belongs to a very different kind of person with a very different kind of mind – creators and empathizers, pattern recognizers, and meaning makers (Pink, p. 1, 2006)."

There is a paradigm shift within the field of education from students' merely gathering information to function in an industrial-age society to the twenty-first century set of skills necessary for functioning within a global society (Darling-Hammond et al., 2008; Silva, 2008). Advances in technology readily available to students and instructors, as well as increased research on the nature of creativity and how people learn, has shed light on the learning process and the way twenty-first-century educators need to facilitate student learning (Friedman, 2005; National Research Council, 2000; Wagner, 2012).

Feiman-Nemser (2001) indicates the ability to reform our education system depends on the quality of our teachers. The characteristics of teaching and learning require a constructivist lens which supports a collaborative process with emphasis on student-to-student and student-to-teacher discourse (Ginsburg-Block, Rohrbeck, & Fantuzzo, 2006; Wolters, 2003). Wiersema and Licklinder (2009) indicate the need for educators to "plan learning opportunities to provide students with experiences that will challenge their old ways of thinking and learning, giving them a reason to develop new habits of thinking deeply about all experiences" (p. 125).

The 21st century approach to teaching requires student-centered pedagogies for authentic learning, collaboration, communication, self-regulated learning, self-reflection, and reflective teaching (Giroux, 2011; Price, 2011). The new learning goals for students are creative thinking, problem solving reasoning, critical thinking metacognition, and higher-level thinking skills (Hursh, 2007; Moore & Stanley, 2010). The reasons for student-centered authentic learning are evident in Noddings (2003) statement that "Education, by its very nature, should help

people to develop their best selves—to become people with pleasing talents, useful and satisfying occupations, self-understanding, sound character, a host of appreciations, and a commitment to continuous learning" (p. 23).

Significant ways to support students twenty-first century skills occur through various pedagogies of engagement: problem-based learning, project-based learning, inquiry-based learning, service learning, and experiential or experimental-based learning (Colby, Ehrlich, Beaumont, & Stephens, 2003; Flecky, 2011; Furco & Root, 2010; Lee, Blackwell, Drake, & Moran, 2014). Such a paradigm shift requires a change in the instructional delivery model from traditional teacher-directed approaches to a constructivist student-directed learning format at the university level for future elementary school teachers. The educational objective for current and future teachers is to facilitate the development of student-directed intrinsically motivated twenty-first-century learners (Wagner, 2012).

The objective of our research is to determine the cognitive and affective behavioral changes of preservice teachers after experiencing a semester-long pedagogy of engagement format. The selected pedagogy of engagement approach is project-based learning that emphasizes 21st-century skill development and how people learn. Our goal is to challenge preservice teachers' beliefs and assumptions about teaching when faced with 21st century learning goals. "Programs that successfully change beginning teachers' understanding about teaching and learning use their students' initial beliefs about teaching as a springboard for surfacing and confronting misconceptions" (Darling-Hammond & Baratz-Snowden, 2007, p. 117). In addition, through understanding the benefits of project-based learning as an interactive approach, educators can design and implement learning opportunities to increase and sustain knowledge acquisition and develop critical thinking.

CONSTRUCTIVIST PEDAGOGIES OF ENGAGEMENT

The term pedagogy of engagement is used to describe an approach to education that promotes student-directed teaching practices that empower students and the professors'/instructors' commitment to the well-being of students (Palmer, 2010). The primary principles of learning within this framework is the promotion of active engagement, academic rigor in critical and divergent thinking curriculum, organization of knowledge, meaningful patterns of information, effort, interest, reflective thinking, differences, socialization, self-regulation, and the contextual transferability to the real world (Lee, Blackwell, Drake, & Moran, 2014; National Research Council, 2000). The various forms of active engagement accentuate learning opportunities for students to become involved with or within a selected community (Flecky, 2011).

The Association of American Colleges and Universities (AACU) (2007) encourages the use of active, hands-on, collaborative, and inquiry-based teaching that promotes the learning process. The premise is that when learners are actively engaged in the learning process, higher achievement occurs. Higher achievement requires seven principles of excellence (AACU, 2007):

1. Aim high and make connections between the essential learning outcomes and life.
2. Facilitate and assess student's plan of study for achieving mastery of essential learning outcomes.
3. Immerse learners in inquiry-based learning and innovation through opportunities to analysis, discovery, problem solve, and communication.
4. Engage students in big questions related to science and society, cultures and values, global interdependence with emphasis on changing economy, and human dignity and freedom.
5. Connect knowledge with choices and action for citizenship through engaged and guided learning on "real-world" problems.
6. Emphasize personal and social responsibility through civic engagement and ethical learning.
7. Assess students' ability to apply learning to complex problems and use the assessment to deepen student learning as well as continuous improvement.

The seven principles of excellence correlate with the major principles of learning. Learning requires active engagement, academic rigor in curriculum to promote critical and divergent thinking, organization of knowledge, meaningful patterns of information, effort, interest, reflective thinking, differences, socialization, self-regulation, and the contextual transferability to the real world (Flecky, 2011; Lee, Blackwell, Drake, & Moran, 2014; NRC, 2000).

Advocates of twenty-first-century skills favor student-centered methods, for example, problem-based learning and project-based learning that allows students to collaborate, work on authentic problems and engage with the community (Rotherham & Willingham, 2010, p. 19). The use of technology in the twenty-first century takes learning opportunities beyond the classroom to national and worldwide audiences (Buckingham & Domaille, 2004). Therefore, at all ages and stages of learning, the focus needs to be on ensuring learners gain the necessary

critical thinking, problem-solving, creativity, innovation, and twenty-first-century skills to be successful (Wagner, 2012).

UNDERGRADUATE STUDENTS IN TEACHER EDUCATION

The ultimate purpose of teacher education is to develop pedagogical skills of future educators to meet the learning needs of all students. Preparing preservice teachers for the classroom is critical to help them develop knowledge, problem solving skills, and critical thinking of the learners in their classroom. To do so, they must experience interactive learning and critical inquiry themselves. Researchers specify pre-existing beliefs from previous learning experiences and cultural backgrounds influence teaching practices and perceptions of teaching (Johnson, 2009; Ogilvie & Dunn, 2010; Pajares, 1992). In addition, they also identified that there are a variety of factors contributing to and limiting positive connections between beliefs and learned teaching practices (Johnson, 2009; Ogilvie & Dunn, 2010; Pajares, 1992).

Pajares (1992) indicated that students rely on past experiences when formulating personal instructional approach to teaching and learning. Researchers found future teachers resistant to change to an instructional learner-centered approach (Dees, 2006; Klien, 2001). Beliefs and behaviors are egocentrically based because of one's difficulty in perceiving the world from another's perspective (Deci, 1995; Epley, Van Boven, Keysar, & Gilovich, 2004). The ability to incorporate perspective taking instead of personal biases to learn becomes a challenge during the epistemological or learning process for adults (Epley, Van Boven, Keysar, & Gilovich, 2004).

COGNITIVE DISSONANCE

Confronting beliefs and assumptions include cognitive behaviors that activate and influence specific decisions and actions. Darling-Hammond (2006) specifies the need for "explicit strategies to help students to confront their own deep-seated beliefs and assumptions about learning and students and to learn about the experiences of people different from themselves" (pg. 6). This involves students learning how to learn, encouraging reflective thinking, and motivating their peers to learn through collaboration and inquiry-based research (Weimer, 2002).

Wagner (2012) stresses the need for innovation within the field of education that will influence future and current teachers' decisions and actions. He describes two forms of innovation that create change. One is incremental innovation and the other is disruptive innovation, cognitive dissonance. Cognitive dissonance stimulates a fundamental change and a sense of disequilibrium rather than improving what already exists. It is a state of mental discomfort because it challenges personal thoughts, beliefs, or attitudes due to new experiences. Cognitive dissonance requires students to reassess and evaluate their perspectives, attitudes, and values based on self-awareness and self-determination.

Therefore, future educators need to experience cognitive dissonance to engage in perspective taking, divergent and critical thinking. Dissonance occurs when individuals perform actions that contradict personal beliefs, principles, and values. Critical thinking requires analyzing and evaluating thinking with the objective to improve one's thinking (Facione, 2011; Paul & Elder, 2007). It requires students to reassess and evaluate their understanding of concepts, perspectives, attitudes and values through self-awareness, self-determination, and the development of social-emotional confidence.

PROJECT-BASED LEARNING

The theoretical constructivist premise for using project-based learning is the establishment of optimal learning opportunities where students have the freedom and autonomy to engage in purposeful and relevant learning with an emphasis on creativity while integrating new information and concepts with pre-existing perceptions (Hmelo-Silver, 2004; Pink, 2006; Wagner, 2012; Wolters, 2003). The objective for implementing project-based learning is two-fold. First, the structure of the project engages students to connect the interrelationship between textbook, content knowledge, and their role or purpose in the world (Bransford, Brown, & Cocking, 2001; Hammerness et al., 2005). Secondly, it encourages students to use their critical thinking and problem-solving abilities (Hmelo-Silver). Theoretically, students have the freedom and autonomy to engage in purposeful and relevant learning with an emphasis on creativity, while integrating new information and concepts with pre-existing perceptions (Hmelo-Silver, 2004; Pink, 2006; Wagner, 2012; Wolters, 2003). The goal is to advance students' critical thinking through the creation of a relevant problem or driving question that requires self-directed learning and mastery of course content knowledge.

Project-based learning correlates directly with AACU's (2007) seven principles of excellence and the major principles for how people learn. Students actively engage in projects that are associated with their community

and academic content. Students' interests and topics students care about to determine the projects. Table 1 identifies the correlation between PBL key elements, twenty-first-century skills, and AACU's seven principles.

TABLE 1: Correlation between Project-based Learning, 21st Century Skills, and AACU Principles

Project-based Learning Elements	**Twenty-first Century Skills Wagner, 2012)**	**AACU's Seven Principles (2007)**
• Challenging problem or question • In-depth Inquiry • Authentic real-world content • Learner -driven • Community involvement • Multiple forms of assessment • Self-regulation • Choice • Responsibility • Self-direction • Autonomy • Group and self-evaluations	• Critical thinking – problem solving • Collaboration – leading by influence • Agility and adaptability • Initiative and entrepreneurship • Communicating effectively • Assess and analyze information • Curiosity, innovation and imagination	• Connections between learning and life • Mastery of learning outcomes • Inquiry-based learning: analysis, discovery, problem solving, & communication • Real world content: culture, values, society, science, human dignity & freedom • Real world problems • Civic engagement and ethics • Assessment to deepen student learning

RESEARCH

PEDAGOGICAL STRUCTURE-PROJECT-BASED LEARNING

The structure of the study is a project-based learning model. To begin the project, discussions about early childhood cognition and the course content was initiated during the first week of class. Students discussed their perception of teaching and what information they would like to know regarding the differences between the course content they need to understand and what is happening in the real world of teaching. The course focuses on five key components for teaching – development, and learning, assessment, classroom environment, planning and instruction, and reciprocal relationships with students and parents.

Students established small collaborative groups and a driving question they wished to research. Examples of driving questions were: *What is the role of play in the classroom setting? What aspects and principles of child development are used throughout the school day? Why and when are developmental factors (cognition, language, social, emotional, and physical) considered when teaching? What is play and why is it necessary for cognitive development? What is the role of a teacher in the developmental-learning process?* After determining each group's driving questions, research questionnaires were developed by each group and sent via email to current pre-school to third-grade teachers throughout the state of Texas.

Students were responsible for accessing, documenting, analyzing, evaluating and managing all the research necessary to find the solution to their driving question. Group planning, implementation, review, and revisions throughout the research process was requires. Students regularly reflected on their work and personal progress - metacognition. Current teachers responded via email and direct interviews. Interviews were analyzed and evaluated as the responses related to the collaborative groups' driving question.

The final phase of the project was the development of a digital documentary video produced by each group regarding their research as the culminating project. The documentary video was evaluated by members of the education community – practicing pre-school through 3rd-grade teachers, instructional coordinators or administrators for feedback. Via the videos, students had an opportunity to share their research findings with others in and outside the field of education. The project requires students to compare and analyze course content concepts with the teaching community to generate new generalities demonstrated within a video documentary. Figure 1 is a diagram that presents the flow of concept development through project-based learning artifacts to the final product a video.

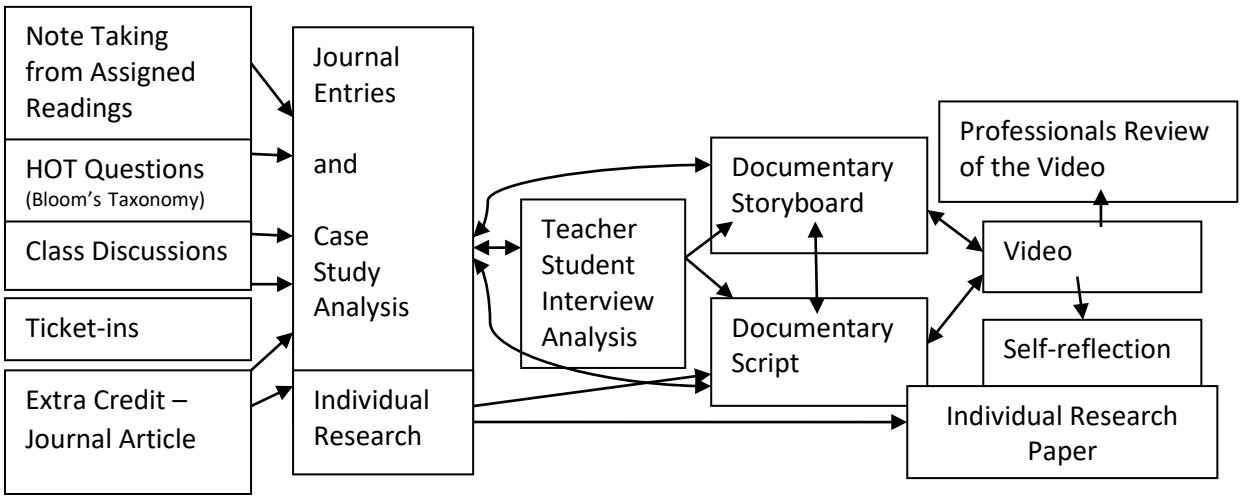


FIGURE 1: Project-based Learning Artifact/Product Development Based on Learning Outcomes

The analytical process provides a self-awareness/understanding of what it will take to complete the project as well as the complexity of the field of teaching. The goal is for the development and internalization of key concepts through internal mental constructs because of the interaction or dialogue with the course material, social environment, and the current world of teaching instead of direct instruction on the part of the professor. Value is therefore placed on the learning process and becomes the necessary engagement of the students for sustainable learning.

METHODOLOGY

PHENOMENOLOGICAL RESEARCH

According to Creswell (1998), "qualitative research is multi-method in focus, involving an interpretive, naturalistic approach in which the researcher attempts to make sense of or interpret phenomena in terms of the meanings people bring to them." (p. 15). Phenomenology follows the collection of information from participants to uncover individuals' perception of their lived experiences. The purpose is to analyze and interpret the data as potentially relevant concepts based on the set of responses. Concepts related to the same phenomenon are grouped into themes-categories.

Methodologically, we adopted the qualitative phenomenological approach because very little has been written about undergraduate education majors' affective and cognitive perception of their transition from teacher-directed teaching to student-directed learning. The attempt is to uncover what phenomenon participants have in common based on their experience (Creswell, 2009). Interpretation of the responses describes the perceptions conveyed by the participants.

Phenomenology focuses on individuals' constructing meaning from an experience. Patton (1990) explains that the aim of the phenomenological research is on the concept that "there is an essence or essences to shared experience" (p. 70). The assumption or essence, like the ethnographer's assumption that culture exists and is important, becomes the defining characteristic of a purely phenomenological study (Patton, 1990, p. 70).

Phenomenological research is concerned with understanding an individual's account of an experience or phenomenon to advance future practices (Finlay & Ballinger, 2006). In this case, the concern is a pedagogical approach for teaching in the twenty-first century that challenges students' cultural perception of learning as well as receiving and delivering instruction; therefore, resulting in students' perceptual changes in cognitive and affective behaviors.

> "Perception is original awareness of the appearance of phenomena in experience. It is defined as access to truth, the foundation of all knowledge. Perception gives one access to experience of the world as it is given prior to any analysis of it. Phenomenology recognizes that meanings are given in perception and modified in analysis..." (Oiler-Boyd, 2001, pp. 96-97).

In general, "a phenomenological research is well suited for studying affective, emotional, and often intense human experiences" (Merriam, 2009, p. 26). According to Creswell (1998), "qualitative research is multi-method in focus, involving an interpretive, naturalistic approach in which the researcher attempts to make sense of or

interpret phenomena in terms of the meanings people bring to them." (p. 15). Using the phenomenology research approach requires an understanding of social experiences shared by a similar group (Creswell, 1998).

Phenomenology research involves examining the meaning of a lived experience. The objective of our research was to determine cognitive and affective behavioral changes of preservice teachers after experiencing a semester-long pedagogy of engagement format. The research hypothesis was the cognitive and affective components of critical thinking would evolve as students emerged from the PBL experience, which included meaningful course content and various opportunities for students to demonstrate self-awareness, self-regulation, self-management, self-motivation, and self-determination.

As addressed previously, an individual's cognitive and affective behaviors (beliefs, values, attitudes, and practices) are perceptions formulated from experiences. Perception affects one's motivation to learn. Cognitive dissonance generates divergent and critical thinking, which leads to changes in an individual's perception. Cognitive dissonance also requires the reassessment and evaluation of perspectives, attitudes, and values based on self-awareness and self-determination. This includes students' ability to listen, respond, interact with others, self-reflection, self-awareness and willingness to revise previous concepts or opinions when presented with new information, i.e. perspective-taking.

Research indicates a correlation between cognitive and affective behaviors that motivate learners' desire to change their conceptual understanding and perceptions. Motivating student learning involves accessing and evaluating intangible factors in cognitive and affective behaviors such as relevance, interests, and actions driven by internal, intrinsic rewards. McKeachie and Svinicki (2006) suggest educators focus on student self-determination, autonomy, and opportunities for choice and control for motivating learning.

PARTICIPANTS

The participants in this study were 47 preservice teachers seeking teacher certification in an EC-6 (early childhood through grade 6) elementary education program or EC-6 bilingual education program. The preservice teachers were enrolled in the fall term in a required early childhood cognition course at a university in southeast Texas. The 47 preservice teachers were in three separate early childhood cognition courses during the semester with the same professor. The following demographic data were obtained. Participants were between the ages of 20-26. Thirty-one of the 47 participants are 20-21 years of age; nine participants are between the ages of 18-19, five participants are ages 22-23 and two 24-26 years of age. Academic status indicated that 30.5% of the participants were sophomores, 57.8% were juniors, and 12.2 % seniors. Gender status revealed 93.9% were female and 6.1% male. Ethnicity status was identified as 72% White; 8.5% Black; 12.2% Latino; 2.4% Multiracial; 1.2% Middle Eastern; and, 3.7% declined to disclose their ethnicity. Of note, the demographic makeup of the courses are reflective of the teaching demographics in the United States in which the majority of teachers are white and female.

RESEARCH QUESTIONS

The research questions were constructed to narrow the scope within the study to the description of cognitive and affective changes within participants using their own words. Participants were asked to describe any changes they could identify because of their experiences. The research questions narrow the scope of the study to identify participants' perception of any cognitive or affective behavior changes they recognized because of their experience. Forty-seven preservice teachers responded to the following questions at the end of their semester-long experience: (a) Reflecting over the past semester, how do you think you have or have not changed from when you entered this course? and (b) Why do you think you have or have not changed?

Written responses also provided students with an opportunity to contemplate and reflect on their semester-long experience. The purpose was to determine and understand the meaning of the experiences and the impact the experiences had on individuals. Such an approach parallels Heidegger's (1927/1962) phenomenological approach in the search for a coherent understanding of the phenomena of teaching and learning. Inductively, patterns became evident with implications toward various self-determination characteristics such as autonomy, motivation, attitude and ability in setting achievable goals, mastery, solving problems, making decisions, advocating for themselves, evaluating decisions, and adjusting to achieve their goals.

DATA ANALYSIS AND TRIANGULATION

Theoretical rigor requires in-depth planning, reasoning, choice of methods and consideration for the phenomenon when analyzing and coding information (Higgs, 2001; Rice, & Ezzy, 1999). Triangulation of data was incorporated to establish comprehensive validity and reliability for the evaluation of data (Teddlie & Tashakkori, 2009). Three faculty members from the College of Education at a southeast Texas university

analyzed the student transcripts: the instructor of the early childhood course, a colleague from another education program and a faculty member from another department in the same college. Additionally, a graduate student participated in the final discussions of themes and codings as an added verification measure. Each researcher independently reviewed 47 student reflections for analysis and coding purposes.

Following Moustakas' (1994) phenomenological research methods, each participant's reflective responses to the two questions were preliminarily grouped. Unrelated information was eliminated when considering the significance of the statements, such as phrases that contained broad, general aspects of the overall experience or presented repetitive and vague terminology. Consistent patterns, as well as clusters of core themes were identified, established and labeled by each of the three researchers. Then, the researchers met as a group to share their findings and determine the final codes and themes. This led to a combined transcript of themes and concepts based on discussions and researcher interpretations. Composite descriptions of the *Individual Textural Descriptions* (Moustakas, 1994, p. 121) were created based on the implications and essence of the experience.

Researcher interpretations were presented and discussed with a fourth party, a graduate assistant, to confirm interpretations and to provide clarification when necessary. When agreement of themes or codings of a few participant responses was not reached, dialogue between researchers and the graduate assistant continued until a consensus was reached. The purpose was to add rigor, credibility, trustworthiness, integrity, and competence within the study's analysis (Crabtree & Miller, 1999).

FINDINGS

Research indicates a correlation between cognitive and affective behaviors that motivate learners' desire to change and conceptual understanding developed during the active engagement in the learning process, project-based learning. Motivating student learning involves accessing and evaluating intangible factors in cognitive and affective behaviors such as relevance, interests, and actions driven by internal, intrinsic rewards. McKeachie and Svinicki (2006) suggest educators focus on student self-determination, autonomy, and opportunities for choice and control for motivating learning.

Five core themes emerged within the phenomenology theoretical framework: autonomy, mastery, purpose, perspective taking, and evaluation. For each theme, students' cognitive and affective perceptual changes because of such an experience are described. The themes align with the pedagogical principles of engagement identified in PBL aligns and AACU's (2007) premise to immerse learners in inquiry-based learning. The following describes the five core themes and the alignment with PBL's and AACU's basic principles. Student written responses validate each identified theme.

AUTONOMY

Autonomy is the ability to take control of one's own learning. The term autonomy equates with AACU's (2007) recommendation to emphasize personal and social responsibility through civic engagement and ethical learning. Autonomy also aligns with the theoretical framework for independent, interdependent and self-directed learning. This allows for critical thinking when making independent and group decisions as well as controlling one's own actions. Autonomy includes collaboration, interdependent decision-making, self-direction, self-regulation, planning, control of one's thinking and interdependence when thinking critically.

Cognitive dissonance emerged because of students' beliefs regarding the role of a teacher. The opportunity for learner autonomy instead of the teacher assuming responsibility for every aspect of student learning originally created frustration and self-doubt. Initially, there was a continuous concern for providing the professor with "what the professor wanted" instead of what the assessment instrument stated needed to be present within the final product/artifact. Fear of failure and the concept of doing something wrong permeated comments. Participants were not accustomed to the role of a teacher as a facilitator and collaborator rather than direct instruction. The purpose of the facilitator and collaborator in a PBL is to support students' sense of autonomy – independent and interdependent decision-making, control of one's own learning.

Student statements represent an acknowledgment of independent and interdependent actions for controlling and driving their own learning:

Independent and interdependent decision-making:

> *She had provided a caring community of learners; in which we were learning to be self-sufficient! To be honest, this was a completely foreign concept to me up to this point.*

I was unprepared for the amount of voice and choice that came with the documentary. I did not know how to handle that much freedom because I never experienced it before.

It was an amazing experience to watch an entire group grow from six classmates into six friends and teachers. I hope that we are all able to carry over the skills to lit block, student teaching and then eventually actual teaching.

In particular, Morgan, Kevin and I really worked well together and were able to get things done quickly and efficiently and had a very good understanding of each other's' ways of communication and could bounce off ideas extremely well.

Control of one's own learning:

When you handed out the syllabus and the assignments that are due, it was more of a shock to everyone because we actually get to think on our own and I think this stressed everyone out - thinking on their own. Because up until this point in time, everyone is used to what the teacher gives you and this is what the teacher specifically wants. There was no outside thinking. And, being in your class we are allowed to think outside the box, think critically, and it is more stressful and overwhelming at first when you're actually allowed to do that.

Everyone just got stressed, we stopped thinking clearly, and we started to lose track of what we were doing. This was the point where we needed to support and collaborate with each other the most, like we had done all semester.

I will continue to think interdependently and remain open to continuous learning in my next education courses. I know that not many other instructors or classes are set up this way so I will always think of this course and how I could use the lessons I am taught in the future to apply to a classroom that I plan to operate just like this one. I guess you can say I had one giant "A-ha moment" that I will never forget!

MASTERY

Mastery promotes deep understanding of constructs or concepts. It requires critical thinking when reassessing and evaluating the understanding of concepts, perspectives, attitudes, and values through self-awareness and self-determination. Gaining deep understanding includes confronting failures, making mistakes, and creating multiple revisions. Once again, students questioned their beliefs and perception about learning and how to learn. Students began to understand that making mistakes is how they learn. They grasp the knowledge that mistakes, and reflective thinking are necessary for learning. Such understanding increased the desire and motivation to complete the project.

Mastery refers to the repetition of an act or exercise to improve and use a new concept. Students sought a right answer at the beginning of their project. There was a paradigm shift in student understanding as to what it takes to reason through their problems rather than having a right answer. The desire for improvement correlates with AACU's (2007) principle for facilitating and assessing student mastery of essential learning outcomes. Theoretically, always improving and striving for accuracy requires critical thinking for revising and rethinking a concept or final solution.

The following quotes exemplify the changes in students' perception that mastery includes making mistakes and multiple answers rather than one right answer:

Critical thinking:

However, this class made me think critically, I had to analysis EVERYTHING!

So, it gets frustrating because when you are doing it, you start thinking outside the box, using your critical thinking skills, and you just naturally feel like you're doing something wrong. You need to reel yourself back in, you know, you're not on task, you are not thinking the way you are supposed to because you don't have a clear guideline and set to address. So now I think it has made it easier for us to realize that it is okay and there isn't a wrong answer. And, we are supposed to think outside the box.

I can now see that from the start of this class you wanted us to start thinking about our thinking and understand what it takes to be an early education teacher. Every assignment was a chance to develop our skills not just busy work like many teachers give and that some of us

thought that just completing an assignment was all we needed to do when we first started this class…

You challenged our ideas, not making us feel wrong but making us re-think them. I could tell that that was especially hard for our group, since we were basically raised to look for the right answer and determine our self-worth based on a grade. It's hard to just switch that way of thinking and form questions and come up with our own answers. But I felt like by the end of the PBL we were able to do that.

I believe I became better at learning because I collected data from the book, internet, and my group members. It might of have been tough but it made me more capable of finding sources and as a teacher once must be able to find different sources each day. My critical thinking and problem solving increased through these projects as well.

Making mistakes:

I feel like, I don't know, I feel like I don't know if it's right. I want to know that I am doing it right. And if I feel like I am not doing it right then I feel lost. I don't know if my point of view is the same point of view as others in the group. I have never really had to think on my own. I was always given the information that I needed to learn to get the right answer. Now, I see my mistakes and many different answers.

I learned to look back and reflect on past experiences, mistakes and use those to apply to new knowledge and learn.

A lot of teachers are perfectionists too so that is probably where a lot of the issues come in, they want to be in control of everything but I mean, how are students going to learn if they can't make their own mistakes?

Self-determination:

Planning takes a lot of time, brainstorming, re-writing and patience with yourself.

All throughout grade school I only wanted A's and I did what I could to get the highest grade possible…While taking this class and creating a documentary. I feel like I am proud of my work for once.

I was learning concepts I had never heard about and developing skills I had never been forced to improve before.

The documentary made me effectively have oral and written communication with others because I had to openly and purposefully talk to my group my members to accomplish and complete tasks.

PURPOSE

Establishing a purpose is a necessary component for learning in the theoretical framework of Deci (1995), Pink (2006), Wagner, (2012) Glasser (1998), and Jung (1957-1958). According to AAUC (2007), purpose requires connecting knowledge with choices and action for citizenship through engaged and guided learning on "real-world" problems. The PBL allowed students to address the real world of teaching.

The PBL pedagogical approach includes student choice, civic engagement with the community and connections to the real world when entering the field of teaching. Purpose connects to the interests, reason, and motivation for learning, pedagogical usefulness, and application of new information based on thoughtfully questioning and reflective thinking. The PBL and pedagogical practices transformed students' understanding of the purpose for teaching and learning. This is evident in their response to survey questions.

Students describe their awareness and understanding of purpose in the following statements:

Future as a teacher:

This class has opened my eyes. I feel that I now have an essential tool needed to be an intentional and effective teacher. More than likely it will take some practice to get used this to but I can do it.

In this course, I made mental connections or frameworks because it relates to me personally and all the assignments tied into the main concepts.

The research we found on what it takes to become an intentional teacher is extremely valuable and I will use what I have learned in all areas of my life, especially when I become an Elementary teacher.

In learning about PBL I've realized this approach can make a huge difference in the way parents and students look at education. Its basis is to create strong problem solvers and innovators.

Being in this class has showed me that when I am a teacher I will have to collaborate with my team; I need to know how to do that. One teacher may think her idea is the best and the other teacher may disagree with that. I have to learn how to handle certain situations.

Personal connection to learning:

The factor that I really enjoyed about this class is that I knew the purpose of every assignment. We were not given "busy work" or "work for grades only" our assignments had a purpose and a meaning to it.

Literally everything ties together in this class. At the time I did not realize that but now I see why we did the assignments every day.

Everything I did had a purpose and a meaning.

PERSPECTIVE TAKING

Perspective taking involves changes in cognitive and affective behaviors from egocentric thinking to accepting different points of view including the interrelationships of concepts and ideas presented by others and empathy. Empathy occurs when someone understands and shares others' experiences and emotions. Perspective taking includes the self-awareness of one's biases, beliefs, and values. The movement from egocentric to perspective taking thinking creates cognitive dissonance. Cognitive dissonance exists as students journeyed through their projects. Statements within the perspective-taking category describe perceptual changes, self-awareness and a paradigm shift including their connection to community, cultures, and values.

Perceptual change:

You are going to have to collaborate on all sorts of stuff ... you are all going to have your different opinions and the way that you do things. But you are still going to have to collaborate. Fortunately, you don't have to all agree on the exact same way of looking at things.

.... this is one of the good things because everybody can have a different opinion so everybody's ideas come together, they make one whole idea.

I have noticed that over this short period of time in this semester my perception of what happens around me has changed. I am much more open to learning thought different ways other than visually and "hands on", which are the way I have always seemed to learn best.

The more engaged and involved an individual is with their group, the better they perform because they are excited to help, more ideas are sparked when they hear someone else's ideas, and tasks and assignments get completed in a timely manner when everyone works together.

Self-awareness:

Every week I had to think about what I was doing and what was going on around me. I had to be able to think and communicate it clearly and not be bias and only think about myself and my opinions.
I had to realize I can't always be a control freak looking for perfection because sometimes the imperfection is what's perfect. We all learned something new and learned to respect each other and pull our strengths and weaknesses together.

Just because I am a kinesthetic learner does not mean that all of my students will benefit most from hands on learning, like I would. This class really helped me, in many different aspects, to

alter my view on how I will want to teach the curriculum for my future classroom. I believe that I will use a project-based learning course curriculum in my classroom."

Now that I am connecting the dots and seeing where I am supposed to be going and actually give my own personal opinion and backing it up I feel a lot better and more comfortable.

I value my thinking a lot more because it is not just my opinion, it is still my opinion, but I have facts that back up why I feel the way I do. My upbringing is my reason for some of the ways I feel.

EVALUATION

The evaluation theme identifies students' awareness of changes in their learning. One of AACU's (2007) principles is to assess students' ability to apply learning and to deepen student learning as well as continuous improvement. Student evaluating and assessing their own learning connects to changes in their affective behaviors – judgment, values, and beliefs. Students reference changes from their initial need for approval at the beginning of the course to satisfying one's own needs. Students evaluated their PBL experience to changes in the divergent and cognitive thinking. The following student statements describe the assessment of their personal improvement, learning, the learning process and sustainable learning because of the PBL pedagogical approach:

Personal improvement:

I don't want my students to learn the way I did. I want to be an intentional teacher that helps my students achieve success and inspire them for greatness….. through Project Based Learning each student has the ability to reflect on their work and explore new things to find answers.

I am not really sure how to describe the way I feel now. It is almost like a lightbulb has gone off in my head but at the same time I feel like a kid. Able to use my imagination to set up a pretend classroom of students and be creative with developing a lesson plan.

Reflecting on the PBL now, I see how much I have changed, not only in my ways of thinking but also in my attitude towards school. I have learned that everyone learns differently, and how I learn is my way and I can change it anytime and any way I want to (which is really cool to me)

I plan to continue to get better about the skills I need to become the best teacher possible, and also to remember all the concepts that I experienced as a student in this course to spread the word at how effective a classroom that operates this way is, and also to instill this type of learning in my future classrooms.

One of the biggest things I've learned was that teaching is so much more than I expected and even though I'm a little scared, I'm more excited to impact children in a positive way. I will remember to reflect daily on my actions, responses and attitudes, I will manage my time appropriately to ensure that each student feels that they are important and that changes/ adaptions to the curriculum or lessons are done appropriately for individual students. I will continue to use both habits of mind and 21st century skills to help me and I will always collaborate with my colleagues and others.

Learning and the learning process:

I had friends that took other professors for this course and do not know have of the stuff that I have learned in this course. It was a rough semester but I would do it all over again if I had to. This course was seriously one of my most eye-opening courses I have taken in my entire college career. I learned more in this course than I have in any other.

Remaining open to continuous learning was a struggle for me because once I have something on my mind I do not like to change it. I had to learn to listen with my ears open not closed and understand what the teacher was actually telling me.

…. through Project Based Learning each student has the ability to reflect on their work and explore new things to find answers. And for myself, the free range this course has, given me through Project Based Learning has, been very gratifying and has helped me come to realize that students are capable of anything, including myself.

It helped to grasp how all that we learn in a class somehow connects back to something else that we have previously learned.

….. I was so frustrated the whole time. I thought there was so much work, there was so much to do and it was more than I can handle. I honestly didn't understand why we did things like journal entries every single week and had to be so thorough, so developed, and you know I didn't understand the point of driving my own learning. You know because I never learned that way in my life….Now that I kind of reflect back on it, I am so far ahead in my other classes than absolutely anyone else…

After this semester and realizing the difference in PBL and standardized testing, in my opinion the way we were being taught did not promote any higher-level thinking, didn't prepare us for the real world, and we grew up lacking how to question.

LIMITATIONS

Potential limitations in coding may have occurred as it was completed without confirmation by the students who provided the narrative reflections. Each researcher did provide a coding method that allowed for consistency in the coding process through multiple perspectives. Of the 70 students who participated in the course, only 47 chose to respond to the questions: *Reflecting over the past semester, how do you think you have or have not changed from when you entered this course and not? Why do you think you have or have not changed?* Therefore, a larger sampling is needed to determine changes in motivation to generalize findings to a broader population. It would be beneficial to conduct follow up research to determine whether students transfer their learning and experiences in the project-based approach to their future teaching pedagogy. Further, research on the diverse learning experiences of various demographic groups would be of interest.

DISCUSSION AND CONCLUSIONS

Preservice teachers in these learner-centered teaching methods courses which implemented project-based learning, initially struggled with a learning approach that was different than their previous learning experiences. This is consistent with Dees (2006) findings in which preservice resisted interactive learning approaches in the college where he taught. Similarly, Lortie (1975) and Pajares (1992) postulated that preservice teachers rely heavily on their past experiences as students to form their personal beliefs of teaching and learning. However, despite the initial disturbance in views of teaching and learning expressed by preservice teachers' frustrations, this study revealed the phenomenological changes in perceptions of preservice teachers when encouraged to challenge their pedagogies and cognitive learning behaviors as teacher educators.

Current research indicates the need for instructional practices that vary from students' past educational experiences. Future teachers need to provide curriculum and assessments that promote higher-order skills (Darling-Hammond, 2006). Such a focus presents a challenge for preservice teachers. They need to learn how to reassess and evaluate their perceptions, adjust their attitudes and values through self-awareness, self-determination, and the development of social-emotional confidence. This process of self-evaluation stimulates cognitive dissonance and challenges current beliefs. Therefore, our research question addresses how our preservice teachers responded to a teacher-training framework, PBL pedagogy, which mirrors twenty-first-century curricular changes.

Our phenomenology study identifies undergraduate education majors' cognitive and affective perception of behavioral changes after a semester-long PBL pedagogical approach to learning. There were multiple reasons for implementing the PBL in a foundation education course. First is the need to grasp the connection between academic course content and current teaching practices. Secondly, what students are learning in beginning education coursework may or may not replicate what is happening in current classroom settings or teaching practices. Students' PBL driving questions expose students to what is happening inside and outside the academic setting of higher education. Third, challenging personal values and beliefs, which are based on their experiences; therefore, requiring a re-evaluation of priorities when entering the teaching profession. Lastly, students have the opportunity to evaluate the relevance of what they are learning inside and outside the academic setting i.e. higher-order thinking skills, collaboration, clear communication, habits of mind, twenty-first-century skills, self-awareness, and self-determination.

The findings in this study demonstrate how a PBL pedagogical approach can change students' cognitive and affective behaviors. Twenty-first-century skills accentuated by Wagner (2012) became apparent to the students themselves. Although apprehensive at first, students revealed how challenging it was to alter their mindset for gaining information from direct instruction to directing their own learning, mastery. Most noted that they had always been in a teacher-directed learning environment and had little choice and voice, so for many, this was an

affective awakening of sorts when able to direct their own learning, perspective taking. The students also demonstrated mastery when they were able to transfer what they had learned to what they will do as future teachers. Students came to rely on one another and welcomed the collaboration, autonomy. Now, this was not the case for a few groups, but students also learned to voice their concerns when a group member was not taking care of their part of the project. Additionally, the evaluation of their own learning recognized changes in their cognitive and affective behaviors.

REFERENCES

Altan, M. Z. (2006). Beliefs about language learning of foreign language major university students. *Australian Journal of Teacher Education*, *31*, 45-52.

American Association of Colleges and Universities (2007). *College learning for the new global century.* Washington, DC: AACU.

Bransford, J. D., Brown, A. L, & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school* (Expanded edition). Washington, DC: National Academy Press.

Crabtree, B., & Miller, W. (1999). A template approach to text analysis: Developing and using codebooks. In B. Crabtree & W. Miller (Eds.), *Doing qualitative research* (pp. 163-177) Newbury Park, CA: Sage.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. London: Sage.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed approaches*. Thousand Oaks, CA: Sage.

Darling-Hammond, L. (2000). Authentic assessment of teaching in context. *Teaching and Teacher Education, 16*, 523-545.

Darling-Hammond, L. (2006). Constructing 21st-centruy teacher education. *Journal of Teacher Education,* 57(10) 1-15.

Darling-Hammond, L., & Baratz-Snowden, J. (Eds.). (2007, Winter). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve. Educational Horizons, pp. 111–132.

Deci, E. L. (1995). *Why we do what we do; Understanding self-motivation*. London, UK: Penguin.

Dees, D.M. (2006). "How do I deal with these new ideas?" The psychological acculturation attitudes of rural student. *Journal of Research in Rural Education,* 21(6) 1-11

Epley, N., Van Boven, L., Keysar, B., & Gilovich, T. (2004). Perspective taking as egocentric anchoring and adjustment, *Journal of Personality and Social Psychology*, 87 (3) 327-339

Facione, P. (2011). *Think critically*. New York, NY: Pearson

Finlay, L., & Ballinger, C. (2006). *Qualitative research for allied health professionals: challenging choices*. West Sussex, UK: Wiley.

Flecky, K. (2011). Foundation of service-learning. In K. Flecky & & L. Gilow (Ed.) *Service-learning in occupational therapy education: Philosophy and practice* (pp. 1-18). Boston, MA: John & Barlett.

Ginsburg-Block, M. D., Rohrbeck, C. A., & Fantuzzo, J. W. (2006). A meta-analytic review of social, self-concept, and behavioral outcomes of peer-assisted learning. *Journal of Educational Psychology, 98*, 732–749.

Giroux, H. (2011). On critical pedagogy. New York, NY: Continuum.

Hmelo-Silver, C.E. (2004). Problem-based learning: What and how students learn. *Educational Psychology Review, 16* (3), p. 235-266.

Hursh, D. (2007). Exacerbating inequality: The failed promise of the No Child Left Behind Act. Race, Ethnicity and Education, 10(3), 295-308.

Johnson, K. E. (2009). *Second language teacher education: A sociocultural perspective.* New York: Routledge.

Lee, J. S., Blackwell, S., Drake, J., & Moran, K. A. (2014). Taking a Leap of Faith: Redefining Teaching and Learning in Higher Education through Project-Based Learning. *Interdisciplinary Journal of Problem-Based Learning*, *8*(2) 19-34.

Lortie, D. (1975). School teacher: A sociological study. Chicago: The University of Chicago Press.

Maclellan, E. (2008). The significance of motivation in student-centered learning: A reflective case study. *Teaching in Higher Education, 13*(4) 411-421.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Moore, B., & Stanley, T. (2010). Critical thinking and formative assessments: Increasing the rigor in your classroom. Larchmont, NY: Eye on Education.

National Research Council (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academies Press.

Noddings, N. (2003). Happiness and education. New York, NY: Cambridge University.

Oiler-Boyd. C. (2001). Phenomenology: The method. In P.L. Munhall (Ed.). *Nursing research: A qualitative perspective* (3rd ed.) (pp. 93-122). Sudbury, MA: Jones & Bartlett.

Pajares, M.F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307-332.

Patton, M. Q. (1990). *Qualitative evaluation methods* (2nd ed.). Thousand Oaks, CA: Sage.

Paul, R., & Elder, L. (2007). *The miniature guide to critical thinking concepts and tools*. Dillon Beach, CA: The Foundation for Critical Thinking.

Pink, D. (2006). *A Whole New Mind, Why Right Brainers Will Rule the Future*, New York, NY: Penguin Group.

Price, D. (2011). Learning Futures: rebuilding curriculum and pedagogy around student engagement, FORUM, 53 (2) 273-284.

Rotherham, A. J., & Willingham, D. T., (Spring, 2010). "21st-century" skills not new, but a worthy challenge, *American Educator*, 17-20.

Wagner, T. (2012). *Creating innovators – The making of young people who will change the world*. New York, NY: Scribner.

Weimer, M. (2002). *Learner-centered teaching, Five key changes to practice,* San Francisco, CA: Jossey-Bass

Wolters, C. A. (2003). Regulation of motivation: Evaluating an underemphasized aspect of self-regulated learning. *Education Psychologist*, *38*(4), 189-205.

DIFFERENCES, LIMITATIONS AND ADVANTAGES OF EFFECTIVE ONLINE AND FACE-TO-FACE TEACHING METHODS FOR A MEDIA ARTS COURSE

Jung Hyun Moon, MPS
Assistant Arts Professor
NYU Shanghai
jh.moon@nyu.edu

Jace Hargis, PhD
Professor; Director Center for Teaching & Learning
NYU Shanghai
jace.hargis@gmail.com

Hui-Ching Lu, MA
Lecturer
NYU Shanghai
hcl5@nyu.edu

ABSTRACT
This study assesses the differences, limitations and advantages of online teaching and learning in interactive media arts (IMA) and design education. This research traces the development of alternative methods and activities for effective online teaching and learning during a sudden migration from face-to-face (F2F) to online caused by the outbreak of the COVID-19. Data and reflections were gathered and qualitatively analyzed from media production and programming courses. The courses were conducted with newly developed and adjusted methods including synchronous online lecture, live-coding, discussion and presentation, asynchronous video tutorial, virtual office hours, responsive communication and online exhibition. In addition, various methods of trouble-shooting students' code issues were explored, which included Slack, Google Drive, Atom Teletype, VS Code LiveShare and Zoom ScreenShare. Findings reveal that the adjusted online methods produced similar outcomes to F2F instruction. The results display positive assessments of students' engagement and adaptation to online teaching and learning.
Keywords: Online Teaching, Live-coding, User Testing, Video Tutorials, Virtual Office Hours, Troubleshooting, Responsive Communication

INTRODUCTION

The study was conducted at a university which is a joint US/China international liberal arts undergraduate university placed in Shanghai with half Chinese students and half international students. Located in China, the university was one of the first universities to issue a quick transition in teaching and learning due to COVID-19. In response to the pandemic, the university took several actions to migrate courses online. First, the university delayed the schedule of the Spring 2020 term, which provided two extra weeks for faculty to redesign their courses for online instruction. Moreover, to support faculty move their classroom teaching experience to an online environment smoothly and timely, the Center for Teaching and Learning (CTL) provided a variety of resources, tools and techniques for faculty to adopt in their online courses. Berman, McLaughlin, Bass, Pauly, and Zellman (1977) found that an instructor's belief and support affect their students' performance. Throughout the semester, CTL offered a series of pedagogical support for faculty, including workshops, one-on-one consultation sessions, online class observations/midterm student perceptions, research for online teaching in the form of weekly blogs, a Celebrate Online Teaching Non-Conference, an Introduction to College Teaching Credential Course and an Advanced Course Design Studio (CDS) on Teaching Research to help faculty create an effective and rewarding online teaching environment and further enhance students' online learning experience. This approach mimics the powerful educational backward design model by Wiggins and McTighe (1998), where they encourage instructors to begin with learner outcomes, followed by gathering evidence (assessment), and finally designing the learner active experience. With the support from the university, CTL, faculty and students' creativity and flexibility, the migration of online courses turned out to be a fulfilling experience for both faculty and students. The future development of online courses is facilitated and enhanced by faculty's reflection and students' feedback on the courses' effectiveness.

Teaching online is often considered more challenging and time consuming than traditional face-to-face teaching (Chiasson, Terras, & Smart, 2015; De Gagne, 2009; Freeman, 2013; Lewis & Abdul-Hamid, 2006; Mills, Yanes, & Casebeer, 2009). The Primary Author (PA) had the same experience while the PA migrated his courses online after receiving an announcement from the university to transition to online. Since the PA did not have a prior experience of online teaching and learning, he attempted to accomplish the same learning outcomes with

alternative teaching and learning methods as face-to-face (F2F). In order to meet the same outcomes (Wiggins & McTighe, 1998), various teaching and learning activities and techniques were developed.

This manuscript is written after the whole semester to share the PA's detailed experiences, processes and outcomes and to contribute to research on planning, designing and delivering online courses. The circumstances and issues the PA encountered will be demonstrated and the alternative solutions, resources, tools and techniques will be discussed. Through teaching online courses in the semester, the PA attempted to incorporate a "Teaching as Research" lens to pursue the following research questions.

RESEARCH QUESTIONS (RQ)

What are the differences, limitations and advantages of effective online and F2F teaching methods for a media arts and design course?

1. What are the alternatives for effective online teaching and learning during sudden transition?
2. What is the final outcome, result or product of the alternatives for effective online teaching and learning?
3. How do we capitalize on the perception of limitations for online learning into creating opportunities for all students to engage in the process?

OPERATIONAL DEFINITIONS

In this study, we will interpret the following terms:

Online Teaching is the delivery of instruction using different web-based technologies, from the Internet or an intranet and other communication technologies, that enable students to participate in learning activities beyond the campus, from students' homes to workplaces and other locations (Zhu, Payette, & DeZure, 2003). Online learning is an education that takes place synchronously and/or asynchronously over the Internet.

Live-coding is an approach to teaching programming by writing actual code during class as part of the lectures. In a live-coding session, the instructor thinks aloud while writing code and the students are able to understand the process of programming by observing the thought processes of the instructor (Soosai Raj et al., 2018). It is the process of writing source code that is made visible by projecting or streaming the computer screen in the audience space, with ways of visualizing the code (McLean, Griffiths, Collins, & Wiggins, 2010). It is most prominent as a performing arts form and a creativity technique centered upon the writing of source code and the use of interactive programming in a conversational and improvised way (Magnusson, 2013).

User Testing is a technique used in user-centered interaction design to evaluate a product by testing it on users. This can be seen as an irreplaceable usability practice, since it gives direct input on how real users use the system (Nielsen, 1994). The interface and functions of a product such as a website and application (app), are tested by real users in realistic conditions. Through the process of user testing, the usability of the project is evaluated. The testers interact with the product naturally without specific instructions to identity whether the system and functionalities are intuitive and comfortable enough.

Video Tutorial is an audiovisual learning resource to transform a passive viewing experience into an active learning experience. It is a guide and activity for the students to engage with a subject, make observations, visualize information, follow specific steps of a technique, and challenge with questions related to the topic presented in the video.

Virtual Office Hours (VOH) are similar to in-person office hours although they provide students with greater access, while using the instructor's time more efficiently. Benefits of VOH are increased student use; more availability for students with demanding schedules; increased productivity for instructors and students; small group participation in the same office hour conversation; reduction of the number of individual emails on the same topic.

Troubleshooting is a systematic approach to problem solving that is often used to find and correct issues with complex machines, electronics, computers and software systems (Rouse, 2014). In this study, troubleshooting is a form of assistance that instructors guide learners to solve issues of their projects. It demonstrates the process of identifying a source of a problem, debugging the issue and making their project operational or improved towards their idea.

Responsive Communication is not a set of rules; it is a set of tools. That means that it is always necessary to pick the right tool for the occasion (Scollon & Scollon, 1986). It is an essential source of interaction between an

instructor and students. It prevents isolation during online learning by increasing the presence of instructors. Based on the communication policies and instructor and student preferences, various communication tools are employed to respond to their questions or feedback. Phone calls, synchronous video conference tools, direct messages (DM) or text messages are options to use.

LITERATURE REVIEW

Course Migration and Learning Effectiveness

The spread of COVID-19 has posed new challenges on higher education around the world. Colleges and universities were forced to adjust and make a quick transition to adapt to this unprecedented situation (Bothum, 2020). One of the solutions adopted by many universities is to migrate courses online (Sanger, 2020); therefore, moving F2F courses which most faculty are familiar with to online courses successfully in such a short time has become the prioritized issue for every educators and institutions (Bothum, 2020; Terenko & Ogienko, 2020). Terenko and Ogienko (2020) aimed to identify approaches to teaching online courses in higher education because they found all the faculty in their survey expressed their concerns about whether they could make a complete transition to online instructions. Some of them showed uncertainty about the lack of well-designed curriculum resources, effectiveness of online learning management tools. On the other hand, students were worried about their self-learning skills and the lack of real-time communication with instructors and peers. However, despite all the concerns and uncertainty, both faculty and students agreed that the transition to online instruction was necessary and the only solution to the pandemic, and they were ready to face the difficulties.

To overcome the difficulties, many universities have taken actions to effectively move the college classroom experiences to the online environments (Cruickshank, 2020; Sanger, 2020). At the University of Delaware, they modified their grading options, because research (Moawad, 2020) indicated that among the worries and fears students were experiencing during the pandemic, uncertainty about the exams and assessment was the most intense one in their academic stress. Different online resources, like free virtual tutorial sessions, and wellbeing resources were also provided to support students in different ways. There was assistance for faculty as well. Faculty were encouraged to participate in different workshops which help with creating learning contents, the use of learning management systems (LMS), and assessment. Faculty also showed their flexibility and creativity during the process of migration to online courses. For example, they started a buddy system with a more experienced faculty in online instruction paired with a less experienced one; they created a teaching resources forum, where faculty could share tips, examples and reflections on their teaching experiences online. It showed that in this sudden shift of situation, a support system is extremely important for both faculty and students. Overall, the transition to online instruction and the effective use of e-learning technologies and resources can help us thrive under the impact of the pandemic on our education system.

Online Teaching and Learning: Course Design and Interaction with Students

Online learning, or e-learning has become more and more popular (Huang & Hsiao, 2012) due to several advantages. Bouhnik and Marcus (2006) indicate advantages of e-learning, including freedom to decide when and where to learn the content; freedom to express ideas and ask questions: accessibility to course materials based on students' own interest. In summary, e-learning uses online technologies to "create, foster, deliver, and facilitate learning, anytime and anywhere" (Liaw, 2008, p. 864). E-learning effectiveness can be influenced by course design, multimedia learning content, interactive learning activities and the quality of LMS (Liaw, 2008). There are also many studies related to students' learning outcomes and perceived satisfaction to online learning. Kang and Im (2013) found that interaction is the most important factor in predicting students' learning outcomes. Their research examined what element in learner-instructor interaction can predict the learning outcomes in an online learning environment. Firat, et al. (2019) investigated causal correlation between engagement time and learners' academic achievement. The result showed that academic achievement increased significantly when learners engage more with the online learning materials. Krause and Coates (2008) also noted the association between students' engagement and high quality in learning outcomes. In other words, learners' engagement with learning content and their interaction with instructors and peers are essential to obtain an effective online learning experience, and eventually reach desired learning outcomes.

Therefore, how to facilitate student engagement with learning materials and student interaction in the virtual setting are significant in online course design. There are many techniques and activities to enhance student engagement and interaction. The two major formats in online instruction are asynchronous online learning, where students can learn the online materials anytime and anywhere and synchronous online learning, where requires real-time interaction between students and instructors, and among students (Casey, Shaw, Whittingham, & Gallavan, 2018). Some of the technology tools used for asynchronous instruction include downloadable pre-recorded lectures, forums and discussion boards, email communication, Google drive and other collaborative platforms (Casey, Shaw, Whittingham, & Gallavan, 2018). Research has recognized the effectiveness of

asynchronous instruction to foster student learning (Huang & Hsiao, 2012; AbuSeileek & Qatawneh, 2013; Hrastinski, 2008; Murphy, Rodríguez-Manzanares, & Barbour, 2011). It has been observed that asynchronous communication could facilitate in-depth learning and critical thinking because students have more time to process information and form the knowledge (Benbunan-Fich & Hiltz, 1999). However, in asynchronous learning environments, one of the main drawbacks is the delayed feedback provided to students. Moreover, learners may easily feel separation in the learning process due to the lack of social interactions (Branon & Essex, 2001). The mode of synchronous communication can make up for the limitation of asynchronous communication. Through affordable and advanced tools, like web-conference, live chat, and virtual office hours, instructors can provide feedback to students easily and promptly, and encourage live participation and interaction between students and instructors and among peers (Casey et al., 2018; Huang & Hsiao, 2012). This feature has a positive impact on building connections and a supportive learning community online.

How Creativity Often Stems from Limitations and Obstacles

In the article written by Jacobs (2016), the author believes constraints stimulate people's creativity. The examples in filmmaking and advertisement show that “the creativity works better with obstruction”. The research conducted by Metha and Zhu (2016) examined how resource availability has an impact on people’s creativity of using resources. They found that when resources are available sufficiently, people simply do not use them in innovative ways. However, if people face shortage of resources, this challenge makes them utilize the resources creatively. As Oppong (2017) noted, constraints force people to think, so at the same time constraints bring out people’s potential and creativity. This idea echoes with pedagogy in education. One of the e-learning benefits which Capper (2001) proposes is “new educational approaches". In other words, due to different opportunities and limitations, online instruction creates many new options and learning strategies which are not found in F2F instruction. Especially during the pandemic, faculty need to incorporate practical resources and tools into their teaching. Cruickshank (2020) suggests that educators should think creatively to design learning activities and assessment using existing resources. On the other hand, students also have to learn the content and complete assignments remotely without easy-accessible software or hardware, so it is a valuable opportunity for students to think outside of the box and inspire their creativity to face different challenges.

METHODS

This study was conducted at a small private research university with a US/China partnership. The design is a single participant (instructor) case study of instructor reflections on courses that he taught pre and post pandemic conditions. The participant is one male Assistant Professor, who has taught in higher education for the past four years. He holds a graduate degree from an Interactive Telecommunications Program and started his educational career as a Research Resident. He has taught foundation courses, including Interaction Lab, Communications Lab, Creative Coding Lab. He has also taught elective courses, Kinetic Interfaces, Nature of Code and Machine Learning for New Interfaces.

Data was collected during the spring semester, 2020 and compared to data from the prior spring and fall term, 2019. The data focuses on two courses, Communications Lab and Nature of Code, which consisted of students between the ages of 18-27 with various majors, years and mixed cultural identity differences. The description and demographic are as follows.

Communications Lab (CommLab) is a foundation course designed to provide students with a framework to effectively communicate through digital means, students explore the possibilities of digital media by producing projects that make use of digital images, audio, video, and the Web. Students learn in a laboratory context of hands-on experimentation, and principles of interpersonal communications, media theory, and human factors will be introduced in readings and investigated through discussion. Students learn the principles of digital imaging, recording and editing video and audio with Adobe Photoshop, Audition, and Premiere, and the basics of fundamental web languages hypertext mark-up language (HTML), Cascading Style Sheets (CSS) and JavaScript (JS) to establish a diverse digital toolkit. Both traditional and experimental outputs, including online and interactive media platforms, will be explored. Weekly assignments, group and independent projects, and project reports will be assigned in each of the core areas of study.

Nature of Code (NoC) is an intermediate elective course designed based on Daniel Shiffman’s (2012) The Nature of Code course, adjusted for students of undergraduate studies. This course explores the fundamentals of programming, such as Object-Oriented Programming (OOP), and application of simple principles of mathematics and physics to recreate natural behaviors in a digital environment. Throughout the course, students will learn to add layers of physical complexity to make programmed behaviors of Objects more realistic and systematic. Students will integrate their programming skills with diverse topics in Computer Science, Mathematics and Physics, and expand the concepts by utilizing new and interdisciplinary media.

Table 1: Demographic Data.

Course and Term	CommLab Spring 2020	CommLab Fall 2019	NoC Spring 2020	NoC Fall 2019
Total Number of Students	12	14	12	17
Freshman	8	2	1	0
Sophomore	3	5	8	9
Junior	0	5	1	1
Senior	1	2	2	7
Majors				
Interactive Media Arts / Interactive Media & Business	0	4	6	10
Computer Science	3	0	2	4
Social Science	1	2	2	0
Business and Finance / Business & Marketing	1	4	1	0
Biology	0	1	0	0
Global Liberal Studies	0	1	0	0
Media, Culture, and Communication	0	1	0	0
Neural Science	0	0	0	1
Undecided	7	1	1	0

PROCEDURE

In late January, 2020, due to an outbreak of the COVID-19, the university announced that the spring semester classes were postponed for two weeks and soon online learning was adapted. In collaboration with three other instructors in the department, the PA redesigned the course content of CommLab and NoC and created a new online learning experience that accommodated students and the course learning outcomes.

On 30th January, 2020, the PA and three other CommLab instructors held their first meeting to restructure and revamp current education practices, methods and models. A mix of synchronous and asynchronous methods, which include live streaming presentations and discussions, personal tutorials and live-coding support, step-by-step tutorials (slides and videos) were established, as well as repositories with specifically-designed reading and coding resources. These meetings were carried out until mid-February, the instructors developed a new delivery strategy that consisted of various tools for online learning experience, such as Zoom, Slack, Discord, Atom Teletype, VS LiveShare, LMS for Streaming Service and a Youtube channel. They also restructured the course WordPress (WP) blog including Google Calendar to facilitate students in different time zones.

For the NoC course, the PA used similar strategies as CommLab. The PA focused on bringing live-coding to the online setting as the main teaching and learning model of the course. Online live-coding with Atom Teletype was used throughout the semester, which created an online environment similar to those previously taught F2F. A new, useful tool was identified through online teaching that allowed easy annotating and drawing on the screen and was integrated with the live-coding method.

In March 2020, the CommLab instructors discussed their online teaching experience and its effective and ineffective methods. After the first main project Interactive Story, it was noticed that students needed additional time and support to finish all aspects on time because of the challenging situation of migrating online quickly. New adjustments to an online learning setting, different time zones and increased anxiety impacted students' performance. After a discussion between the Instructors and fellows, responsive communication methods were developed for students to receive sufficient advice and support. The PA held frequent virtual office hours via Zoom and successfully troubleshooted students' issues.

In addition, there were major changes in two other main projects of CommLab, Soundscapes and Interactive Documentary. Since students were unable to use the university check-out system for professional recording and filming equipment, such as Tascam audio recorder and Canon 6D, an alternative option using their phone for recording audio and video was suggested. To provide an engaging and rewarding learning experience with phone recording and shooting, guest speakers in the field were invited to offer workshops via Zoom video conference. User testing and presentation of those two projects were particularly challenging due to the technical limitation of Zoom. Adapted methods for online user testing and presentation were also developed.

The department has a tradition of offering a campus-wide end of the semester show highlighting students' works. Classrooms are transformed into a large exhibition space for a one-day exhibition. This exhibition is a perfect opportunity for students to engage in authentic experiences, proudly promoting and explaining their creations. However, due to COVID-19 pandemic, the F2F show could not be held at the end of the spring 2020 semester. In response to the issue, faculty across three campuses brainstormed to create an alternative virtual event. The event created was a two-day exhibition of recent creative interactive student projects. The projects were uploaded to the web and accessible to the campus community. There were also live events in which students presented their projects in real time via Zoom.

As the online class progressed, the teaching methods and activities stabilized and students displayed signs of adaptation and engagement based on their positive outcomes, feedback and instructor evaluations.

Synchronous Online Lecture with Zoom

The CommLab and NoC courses were conducted as a synchronous online course via Zoom.

- Shared lecture notes and video tutorials were provided on the course WP blog in advance.
- The PA started a class with a micro-lecture for 10-15 minutes with shared presentations and emphasized essential points of the class and exercises.
- He used the remainder of the time for synchronous activities with video tutorials.
- Micro-lecture was to maximize time for students to follow synchronous activities developed through video tutorials.
- Students had the option to finish the activities asynchronously by following the video tutorials at their convenient time.
- Online live-coding method was utilized for programming concepts and techniques, such as HTML, CSS, JavaScript in CommLab and most topics of NoC.
- NoC Lectures were recorded and provided to view asynchronous.
- The PA simultaneously monitored his lecture streamed via Zoom ScreenShare with a tablet to check issues of online streaming.
- Annotations used for complex concepts allowed students to engage more with the topics and apply in real time.
- The PA frequently encouraged students to respond with a short word or emoji in the class Slack channel during the online lecture to capture the mood of the class.
- Online discussions were organized with a live document and Zoom breakout Rooms.
- Online presentations were operated with adapted methods to Zoom.

Synchronous and Asynchronous Video Tutorials on Youtube Channel

The CommLab instructors created video tutorials that highlight the essential components of each class and provide knowledge and instructions for in-class activities. The video tutorials were uploaded to Youtube before the synchronous session started. There was a discussion about choosing a video streaming platform between Youtube and the university LMS for Streaming Service. It was decided to use a Youtube channel because of its stability. Each instructor produced seven to eight videos (15-25 minutes) based on their expertise.

The video tutorials were designed and quickly developed to provide students more relatable, immediate activities to the topics and learning outcomes rather than to convey technical information via a polished video or blog post. Students were able to access the tutorials from the course WP blog asynchronously and had the option to follow updates.

Online Live-coding with Atom Teletype

The PA offered the NoC classes using live-coding with Atom Teletype and Zoom ScreenShare. Atom Teletype allowed students to watch and edit the instructor’s writing during the class. With the key teaching method, live-coding, the PA taught programming by writing codes from scratch to a completed one integrated with lecture. The PA designed, implemented and thought aloud while writing codes and students were encouraged to follow the process of programming by coding along and observing the instructor’s thought processes. The PA intentionally made mistakes to help students understand the process of debugging. His live-coding allowed students to understand every step of programming, and how to combine diverse programming concepts as a whole. Furthermore, it enabled the students to feel less intimidated by a complex reference on the Internet, and develop a way of decomposing the concepts into accessible pieces.

Annotations and Drawings on Screen with Zoom Toolkit

The PA identified that hand-drawn annotations on the streaming screen was particularly useful to improve students' attention and engagement. In addition, he displayed keystrokes to demonstrate frequently-used

shortcuts utilizing applications. The methods received positive student feedback. Thus, the PA applied the method extensively to his lecture, live-coding, one-on-one meeting and video recordings.

Monitoring Zoom ScreenShare with a tablet

The other useful method identified is monitoring Zoom ScreenShare with a tablet. It allowed the PA to immediately notice mistakes or unstable issues during synchronous sessions. In addition, an electronic pencil on a tablet can be used with the annotation feature on the Zoom toolkit. Writing and drawing with an e-pencil was more convenient than annotating with a mouse or trackpad on the computer. A computer can be only used for streaming class materials while a tablet is dedicated to monitoring and annotation.

Developing a Method to Obtain Frequent Responses during Synchronous Online Session

One of the confusing and challenging aspects of synchronous online teaching was not being able to receive sufficient student feedback and perceive the class atmosphere. The PA constantly encouraged and requested students to share short responses in the Slack channel, including brief answers and various emojis. The method enabled the PA to detect real-time student perceptions.

Online Real-time Discussion (Synchronous Discussion)

Only a few students were actively engaged and led in-class discussion while many other students remained quiet. It has been challenging to receive frequent and adequate responses from all students in a class, especially for a discussion. Therefore, the PA created a discussion activity that enables everyone to participate. The approach included:

1. The PA shares a set of slides in advance that include discussion prompts and empty slides that students can edit during the discussion.
2. Students are distributed into Zoom breakout rooms, which consists of three or four students.
3. Each student initially discusses in their small group for five minutes. Each student is asked to write their key points on the empty slides shared during the conversation.
4. Afterwards, the PA brings all students back to the main meeting room. The whole class continues the discussion.
5. Every student is encouraged to share their ideas and reflections by utilizing a summary of their discussion from the breakout room discussion. The PA streams the slides with the key points the student wrote (link to example slides).

The PA has observed that this approach allows students to present their ideas confidently since they have already discussed in a small group with less pressure.

Online User Testing

In prior semesters, for the main CommLab project, a User Testing day has been arranged a few days before the presentation. It provided opportunities for students to experience and evaluate their project in realistic conditions, share comments, and apply feedback. In addition, it prevented students from finishing their project just before the deadline since the project should be executable during the user testing session.

The CommLab instructors brainstormed and tried to bring a similar user testing activity online by utilizing Zoom breakout rooms. The details include:

1. In a similar way of online discussion, the PA shares slides that include instructions of user testing and arrangement of groups (link to example slides).
2. The PA divides students into breakout rooms.
3. In each group, there are one presenter and multiple testers.
4. One of the testers, a primary tester, shares his/her screen and explores the presenter's project on their own, describing how he/she approached the project.
5. Other testers can provide additional feedback while the primary tester is interacting with the project.
6. The presenter observes the process and takes notes, avoiding unnecessary explanations.
7. Presenter, primary tester and tester roles are rearranged after eight minutes and the process is repeated.

Online Presentations

There were a number of technical limitations for online presentations via Zoom. For instance, Zoom does not deliver audio content with proper quality because it automatically downsamples the audio quality and converts stereo channels to a mono. Additionally, when a video or programming sketch is being streamed over Zoom, there is a significant framerate drop. Therefore, the PA and CommLab instructors developed new presentation methods to address these issues.

1. Students upload their project to the university's network-attached storage (NAS).

2. The instructor creates a set of slides that contains links to the students' projects (link to example slides).
3. The slides are shared with students and guest critics.
4. Students are suggested to modify the slides with additional information that might help viewers to understand their project.
5. A student presents their project.
    a. For 30 seconds, the presenter introduces themself and provides essential instructions to explore the project briefly;
    b. for three minutes, the instructor, peer students and guest critics explore the presenter's project on their own;
    c. for one minute, the presenter offers additional clarification and discussion, and;
    d. for the remainder of the time, the instructor, students and guests share feedback.

Overall, the methods were effective with the audio projects and programming sketches. For video projects, viewers experienced latency of video streaming since a number of people tried to access the same file and increased the traffic on the server.

Responsive Communication

Interaction between instructors and students is critical. To facilitate online communication with students, and student to student, various collaboration applications were employed. The collaboration tools included:

- Zoom for Virtual Office Hours;
- Discord for Virtual Studio, where students casually ask questions to anyone in the department;
- Slack for in-class communication and direct message; and
- Google Drive for sharing project materials and source codes.

Class Workspace and Channels via Slack was identified the most useful, considering the frequency and amount of conversation between the instructor and students. Students direct-messaged (DM) the PA at any time. The rate of receiving DMs was more frequent than emails and F2F office hours.

Virtual Studio via Discord created a studio-like environment since it provided a space where students, staff and instructors can have a quick voice-chat with one-click.

Immediate Responses: Additionally, the PA and CommLab instructors consistently shared their experience of online teaching and solicited student feedback. Based on the feedback, it was recognized that two or three students per section requested additional online support for their main projects. The following support methods were developed:

1. The PA was more responsive in Slack using the following approach:
    a. Try to respond immediately.
    b. If available, answer the question as soon as possible.
    c. If not available,
        i. Inform the student that he is not available and when he will be available.
        ii. Provide guidance to students on resources, such as available fellows or online references.
2. Fellows developed a plan to regularly announce their availability in Slack.

Designing Social Interaction Platform: The PA and CommLab Instructors also attempted to reduce students' burden and provide more opportunities for students to engage, interact, learn and inspire each other. Students were encouraged to post screenshots and short descriptions of their assignments in a Slack channel, rather than write a full reflection. They extended the idea and created a channel called "commlab-gallery" where students could share their projects and socially engage.

Virtual Office Hours (VOH)

As mentioned in Responsive Communication, the PA tried to create a welcoming environment that allows students to freely reach out to their instructor and ask questions via DM. The PA was consistently available on Zoom, Slack and Discord for VOH. It was an experiment as he understood it would not be sustainable.

The form of VOH varied:

- Mostly, Slack DM was frequently utilized. Students asked questions, sharing their issues with screenshots and/or sample codes. The PA answered via DM, sometimes providing example codes.
- Zoom Meeting was employed when in-depth discussion or ScreenShare was required.
- Live Share features of text editors were utilized for complex programming concepts and troubleshooting.

Troubleshooting students' codes via Zoom and Atom Teletype
The PA tried various methods of troubleshooting students' code issues, using Slack DM, Google Drive, Atom Teletype, VS Code LiveShare and Zoom ScreenShare. Through Zoom meeting or Slack DM, initial guidance was given to students with pseudo-codes that described specific steps to resolve issues. If a student still could not find a solution, the PA troubleshot the student's codes in a reverse form of F2F conventional methods by following steps:

- Ask a student to share their source code through Slack or Google Drive.
- Open the source code in **the instructor's** text editor and execute the code on **the instructor's** laptop.
- Share the instructor's screen with the student's code open in the instructor text editor.
- Show the instructor's troubleshooting process via ScreenShare and explain not only how to particularly fix the issue but also debugging techniques in general.
- Leave comments about what the instructor modified.
- Send back the fixed code to the student.

At times, the PA portion was modified intentionally and students were encouraged to re-develop the part on their own.

Frequently Asked Questions (FAQs)
The PA has answered a number of questions sent via Slack DM. Since all questions were answered with text, the PA was able to accumulate FAQs and develop answers, which were shared with all students. This approach was found to be an advantage of online teaching.

Virtual End of Semester Show
A two-day online exhibition of recent creative interactive student projects was held across three campuses. The 2020 Spring Showcase website was created for the audience to visit, navigate and view student projects and links. The student projects were uploaded to department servers or Amazon Simple Storage Service (S3) buckets and they were accessible to the campus community and the public.

Live Events in which students presented their projects in real time via Zoom were the main event for the two-day exhibition. Each course was given 20 minutes for their real time presentation. The schedule was well-guided in the website for the audience, highlighting the current presentations.

The PA used two different strategies for his courses. Since the CommLab was arranged as a first live event, there was no information for the PA and CommLab instructors to anticipate how many audiences would join the live session. Thus, they developed a number of backup plans, utilizing Zoom breakout rooms. The PA organized the Zoom session with four breakout rooms for each CommLab section and 24 extra breakout rooms for individual meetings between a student and audience. The Zoom session was protected by a password and audiences were only able to join the session via the link posted on the website. Twenty-two students and more than 40 audiences participated in the event simultaneously. The PA stayed in the main meeting room and was in charge of introducing the event and distributing the audience to the breakout rooms evenly. Students were well-prepared and the audience showed their engagement on presentations.

Overall, the PA received positive feedback from students, however there was an issue while operating the session with breakout rooms. People from the community who were not familiar with Zoom, such as parents and friends were confused and unintentionally dropped their connection. Also, the PA believed it was not ideal for visitors to have another step to join the actual presentations. Therefore, the PA redeveloped the presentation methods, minimizing the complexities.

For the NoC course live event, a Pecha-Kucha (PK) style presentation method was utilized. The PA created a Google slides template and asked students to insert their PK. Prompts to follow the PK were provided and students prepared slides with only one video and three to five images. During the presentation, the PA screen-shared the slides via Zoom. Students presented their project as the PA proceeded to the next slides. Also, audiences provided questions and feedback in the Zoom chat and often encouraged the presenter with emojis. The PK presentation structure allowed the event to proceed smoothly and finish on time.

RESULTS

Comparison between Online and Prior F2F

Data was collected during the spring semester, 2020 and compared to data from the prior tems, CommLab Fall 2019 and NoC Spring 2019. The goal was to examine potential differences in the teaching modes through teaching method modifications and minor changes of assignments.

Table 2: Communications Lab Learning Outcomes (remained the same for both terms).

Online (Spring 2020) and Prior F2F (Fall 2019) Class
Upon completion of this course, students will be able to: • demonstrate a broad knowledge and experience in Communications (in the context of the Internet), and digital media design; • recognize the context in which digital media operates, both historically, socially, and in current practices; • utilize comprehensively fundamentals of web development and apply HTML, CSS and JavaScript to digital projects; • practice and produce digital content, i.e. audio, photo, video, and develop filming, recording, and mastering skills; • combine web programming with media production techniques to produce creative works; • compose and construct narrative storytelling specifically made for web or mobile platforms; • develop meaningful and effective user interactions, and • produce internet artworks and/or practical web applications by utilizing a combination of concepts and techniques discussed and demonstrated throughout the duration of the course.

Table 3: Communications Lab Assessment on Assignments and Activities.

	Online (Spring 2020)	**Prior F2F (Fall 2019)**
Assignments and Activities	20% Web Collage 20% Interactive Story 20% Soundscapes 20% Interactive Documentary	10% Basic HTML & CSS Website [1] 15% Interactive Comic 15% Soundscapes 15% Interactive Film 15% Internet Art [2] 10% Project Documentations [3]
Weekly Assignments	10% Blog posts Reflection on exercises Responses to readings, viewings	10% Blog posts Reflection on exercises Responses to readings, viewings
Engagement	10% Attendance & Participation	10% Attendance & Participation

Note: Assignments and activities were offered almost the same for both semesters. Modifications in Assessment from F2F to Online **was not due to teaching online**, but a prior conversation took place to **combine assessments**.

[1] Basic HTML & CSS Website in Prior F2F was redesigned as Web Collage which contains in-class exercises.

[2] Internet Art, one of the main projects in prior F2F, was removed to reduce students' burden and allow them to have more time on other projects. It is not due to online teaching as it was already planned in the previous semester.

[3] Project Documentations were included to the assessment of the main projects.

Table 4: Nature of Code Learning Outcomes (remained the same for both terms).

Online (Spring 2020) and Prior F2F (Spring 2019)
Upon completion of this course, students will be able to: • practice and produce the fundamentals of programming; • demonstrate object-oriented programming and integrate why/how to use the concept into practical applications; • apply mathematics and physics in their software environment to create an artifact; • visualize and simulate systematic shapes or movement in natural phenomenon; and • create generative art by using a combination of concepts discussed over the course.

Table 5: Nature of Code Assessment on Assignments and Activities.

	Online (2020 Spring)	Prior F2F (2019 Fall)
Assignments and Activities	25% Midterm Project • Simulation of Force & Oscillation 30% Final Project • Creating Interactive Experience utilizing OOP, Force, Oscillation, Autonomous Agents and/or Fractal concepts.	15% Midterm Project • Simulation of Force & Oscillation 35% Final Project • Creating Interactive Experience utilizing OOP, Force, Oscillation, Autonomous Agents and/or Fractal concepts.
Weekly Assignments	25% Blog posts • Reflection on exercises • Responses to readings, viewings • Writing on case studies	25% Blog posts • Reflection on exercises • Responses to readings, viewings • Writing on case studies
Engagement	20% Attendance & Participation [1]	25% Attendance & Participation

Note: Likewise Communications Lab, projects, assignments and activities were offered almost the same as the prior semester.

[1] Modifications in assessment from F2F to Online was to reduce the rate of attendance.

Differences of Instructional Methods in Online and Prior F2F

The methods listed below are online alternative teaching approaches the PA used to achieve the same learning outcomes. The major differences of instructional methods are addressed.

Table 6: Comparison of Teaching Methods between Online and Prior F2F.

	Online (2020 Spring)	Prior F2F (2019 Fall)
Lectures	• Micro-lecture (10-15 minutes) with shared lecture notes • Zoom recordings provided after each class	• Lecture (30-45 minutes) with shared lecture notes
Tutorials for technical skills	• Pre-recorded video tutorials • Asynchronous options for students to follow the exercise during class time or at their convenient time	• Live-demo during class time • In-class exercises that were conducted after the demonstration
Live-coding for programming concept and techniques	• Online Live-coding with Zoom and Atom Teletype • Zoom recordings for asynchronous options	• Live-coding during class time
Discussion	• Online synchronous discussions with a shared interactive document via Zoom and breakout rooms	• In-class discussions with shared an interactive document
Individual support	• Scheduled (or by appointment) virtual office hours via Zoom • One-on-one assistance via Slack and Zoom at any time	• Scheduled (or by appointment) Office hours • Casual and Individual F2F meetings
Communication and Engagement between the department community	• Discord, Virtual Studio designed for social interaction and casual questions amongst community • Slack channels for students to share references and inspirations	• Department studio for students to stay and actively engage with peer students and faculty/staff members
Audio Project	• Audio Recording with Phone	• Audio Recording with a professional recorder and microphone (Tascam, Shotgun Mic)
Video Project	• Video Shooting with Phone	• Video Shooting with a professional camera and relevant equipment, such as Canon 6D, lightings, tripod •

Equipment for Interactive Installation	• No equipment provided from University's check-out system	• Equipment for advanced interactive methods (KinectV2 - Depth Camera, IMU Wearable Motion Capture Device, OptiTrack Motion Capture system, Brainwave headset reader) provided via University check-out system
The End of Semester Show	• Virtual show across three campuses	• F2F Show held in a physical space

The following are assessments based on students' projects and documentations during online and F2F semesters.

Table 7: Evaluation of Communications Lab Student Projects.

Course and Term	CommLab Spring 2020	CommLab Fall 2019
Total Number of Students	12	14
Exceeded expectations [1]	41.7% (5/12)	21.4% (3/14)
Met Expectations [2]	58.3% (7/12)	71.4% (10/14)
Below expectations [3]	0%	7.1% (1/14)

[1] Exceeds expectations: Students fulfilled course requirements and exceeded expectations with excellent performance. **They accomplished all learning outcomes**.
[2] Met expectations: Students fulfilled course requirements and met expectations with good-performance. **They accomplished all learning outcomes**.
[3] Below expectations: Students did not fulfill course requirements and expectations with poor performance. They failed to accomplish some or all learning outcomes.

Table 8: Evaluation of Nature of Code (NoC) Student Projects.

Course and Term	NoC Spring 2020	NoC Spring 2019
Total Number of Students	12	17
Exceeded expectations [1]	75% (9/12)	35.3% (6/17)
Met Expectations [2]	8.4% (1/12)	64.7% (11/17)
Below expectations [3]	16.6% (2/12)	0%

[1] Exceeds expectations: Students fulfilled course requirements and exceeded expectations with excellent performance. **They accomplished all learning outcomes**.
[2] Met expectations: Students fulfilled course requirements and met expectations with good-performance. **They accomplished all learning outcomes**.
[3] Below expectations: Students did not fulfill course requirements and expectations with poor performance. They failed to accomplish some or all learning outcomes.

Student Projects Presented at the Virtual End of Semester Show

In spite of the challenging circumstances, an unexpectedly large number of student participation was noticed in the virtual end of semester show. Data on student projects and participation are provided:

Table 9: Communications Lab (CommLab): Virtual End of Semester Show.

Course and Term	CommLab Spring 2020	CommLab Fall 2019
Total Number of students	12	15
Number of students participated	7	12
Rate of participation	75%	80%
Number of projects presented	9 [1]	11
Student projects	2 x Interactive Story 3 x Soundscapes 4 x Interactive Documentary	3 x Interactive Story 1 x Soundscapes 3 x Interactive Video 4 x Internet Art

[1] Students were given options to submit multiple projects.

Table 10: Nature of Code (NoC): Virtual End of Semester Show.

Course and Term	NoC Spring 2020	NoC Spring 2019
Total Number of students	12	17 [2]
Number of students participated	8	8
Rate of participation	66%	47% [3]
Number of projects presented	10 [1]	10 [1]
Student projects	2 x Music video and Storytelling with Generative Visuals 2 x Interactive Performance 1 x Generative Visuals 2 x Interactive Video Installation based on motion tracking 1 x Real Time Audio Visualization 1 x Interactive Portrait 1 x Interactive 3D Space Visualization	1 x Storytelling with Generative Visuals 1 x Interactive Dance Performance 1 x Generative Arts with Chinese painting style 4 x Simulations of natural phenomenon with educational purposes 1 x Interactive Video Installation 1 x Real Time Audio Visualization 1 x Interactive visuals based on brain wave

[1] Students were given options to submit multiple projects.
[2] Maximum class size was 16; the PA had more students during the Spring 2019 term.
[3] There was a limitation of space so some of the students could not exhibit their project even though they were willing to participate.

DISCUSSION

Overall, we did not notice major differences in the data between the F2F and online course session. Students constructed similar accomplishments through the alternative methods which the PA adapted to create effective online teaching and learning experience.

RQ 1. What are the alternatives for effective online teaching and learning during sudden transition?

The PA conducted his synchronous online lecture with newly developed online teaching and learning methods, including online live-coding with Atom Teletype, online discussion, online user testing and online presentations via Zoom. The PA actively used annotations and drawings on screen with Zoom Toolkit to draw students' attention and describe complex concepts and techniques. He also developed a method to obtain frequent responses during his synchronous sessions. Additionally video tutorials on a Youtube channel were offered for in-class exercises and asynchronous options.

Live-coding and troubleshooting with a LiveShare feature of text editors and methods for responsive communication are particularly identified as effective and transferable methods to next term. The PA requested feedback on live-coding with Atom Teletype in his NoC course. Ten out of the twelve (83%) students were absolutely positive on the method. Regarding responsive communication, in the course evaluations, 88% of CommLab students and 57% of NoC students shared positive comments on the welcoming environment to ask questions and the PA's instant responses. The communication methods the PA attempted is assessed to be helpful for students to keep up with their study in distanced and isolated situations, increasing the presence of instructors.

Virtual End of Semester Show is also recognized as a transferable online teaching and learning activity. The PA noticed the potential of online exhibitions and live events. As the details are provided in [Table 9 and 10], the participation rate of students was unexpectedly high and similar to the rate of prior physical exhibitions. More audiences were able to participate in the online show because it required no physical traveling and it was easily accessible to those who were not able to be on campus. For example, the live event of Capstone projects had approximately 90 people online simultaneously. The number of audiences was more than the usual in-person capstone presentations. In prior F2F, there were approximately 30 students to present their project and five to ten instructors for evaluation and guest critics. There was a conversation about a blended mode presentation to combine online and F2F presentation and extend to a larger audience in the future. It is expected that an online exhibition will provide instructors with the ability to not only broaden audience participation but also improve student learning outcomes. More inclusive and accessible learning opportunities can be advantageous to design and implement effective online learning outcomes (Hargis, 2014). Learning experience through real-world applications, public demonstration of competence and receiving constructive feedback can be some of the key features to improve student learning outcomes (Hargis, Yuan & Wu, 2020).

RQ 2. What is the final outcome, result or product of the alternatives for effective online teaching and learning?

RQ 2a. Both students in an online setting and F2F achieved learning outcomes.

- Instruments: Syllabus where the LOs were provided for both F2F and Online were exactly the same. Similar projects and exercises were assigned, although the teaching and assessment methods differed between F2F and online.

The PA's initial goal to accomplish the same learning outcomes as F2F was successful. Students, in the both groups exceeded and met expectations, fulfilled course requirements and accomplished all learning outcomes. According to [Table 7 and 8], during the online semester, **100% of CommLab students** exceeded (41.7%) or met (58.3%) the expectations and **91% of NoC students** exceeded (75.0%) or met (8.4%) the expectations. The rates of students who achieved learning outcomes is close to the rates from F2F semesters. Ninety two percent of the students in CommLab fall 2019 and 100% in NoC spring 2019 exceeded or met the course expectations. Below expectations in online settings was caused by asynchronous options. It is noticed that the asynchronous methods need to be improved to motivate students more.

RQ 2b. Both students in an online setting and F2F show similar satisfaction on their projects, according to the rate of participation in the End of Semester show.

- Instruments: comparison of student participation data between online and normal the End of Semester show.

The Virtual End of Semester Show was experimentally organized in a short amount of time. There were a number of discussions about how to motivate students as we initially expected low participation. However, a higher number of students than anticipated volunteered to attend the show. The rates of participation between online and F2F appear similar based on [Table 9 and 10]. **Seventy five percent of the CommLab students** participated in the Virtual End of Semester Show while **80%** joined the show in the prior F2F semester. **Sixty six percent of the NoC students** participated in the online exhibition while **47%** joined the previous show. As mentioned above, the reason that the participation rate is relatively low by 47% was due to space limitation.

The students who participated in the show consistently displayed a high level of engagement throughout the semester and during the live event of the virtual exhibition. As Skinner and Pitzer (2012) explain that engagement is explicitly associated with student achievement, their accomplishment exceeded the course expectations and based on the course evaluation, the level of those students' satisfaction on the course appeared considerably high. Learner satisfaction is one of the key factors for the success of the courses. Moreover, participant satisfaction levels along with their performance are indicators of the formation of online learning environments (Altun, 2008). The result on the student engagement level, participation rate and degree of completion of their projects were similar between online and F2F. It was identified that the online courses and online exhibition were successful.

RQ 2c. The degree of diversity of student projects between online and F2F is similar.

- Instruments: Analysis between student projects between F2F and online by categorizing each group of student projects using areas such as story-telling with Generative Visuals, 3D visualization, simulation, Interactive Portrait, Interactive Dance Performance, Generative Arts, Interactive Video Installation, Interactive Visuals based on brainwave.

Although teaching methods and activities were limited and altered by the online setting, students still produced diverse projects with various ideas, according to the student projects appearing in [Table 9 and 10]. CommLab projects were well-distributed amongst the main projects. In the NoC course, despite isolation and limited resources, students freely explored their own interests and ideas and developed generative arts, storytelling with generative visuals, music videos with algorithmic animation, real time audio visualization, interactive dance performances and interactive portraiture.

RQ 3. How do we capitalize on the perception of limitations for online learning into creating opportunities for all students to engage in the process?

RQ3a. How creativity often stems from limitations and obstacles?

- Instruments: For F2F, students used advanced equipment, such as depth cameras for motion tracking from the stockroom. However, for online, they used common devices such as webcams mounted on their laptops or cellphones.

Online teaching provided students an opportunity to adjust their ideas accordingly, think about alternative and feasible solutions, and attempt new methods to develop their projects (at times) more creatively.

For the final NoC project, students were strongly encouraged to explore all possibilities and not be limited to the confinement of the screen, which could include other media and expanded visuals. In previous semesters, successful projects were created in various forms, such as dance with motion tracking and projection mapping. However students this term were not able to access the equipment, use a studio space and identify collaborators.

Initially, it appeared that the student might have been underserved in the online course. However, the limitations stimulated student perspective, which resulted in considering alternative experimental methods and technologies. Using basic equipment, they produced similar high-quality outcomes as they did in a F2F setting with less resources available.

For instance, one NoC student developed an interactive audiovisual performance called *Digital Shaman* inspired by Korean exorcism ritual and shaman vision. Although he was ambitious to create a real time performance and interactive visuals with large scale projection, he could not secure the proper resources in his home. So he decided to perform and record himself performing. The limited resources created an opportunity for the student to be engaged as a performer for the first time. Another NoC student had an idea to create an interactive portraiture, employing a depth camera and its facial expression recognition feature. Since she also could not use advanced devices, she used machine learning models that allowed her to track body and skeletal data with a common webcam.

CommLab students displayed similar creativity with limited resources. For the video project, students used their phone camera more experimentally, shooting with diverse angles that were not possible with a bulky professional camera. For the audio project, since they were not able to record high quality audio so they explored more on audio editing than recording to produce quality outcomes. There were more audio projects presented during the Virtual End of Semester Show than in prior terms.

Conclusion and Interpretations

There have been hindrances and limitations in online teaching and learning, but also a number of advantages and potentials are found. Hargis (2020) mentioned in his article, "We should take this opportunity to completely rethink education, especially to be more inclusive and accessible to all of our students." Although the PA and his collaborators have developed "alternatives" due to the pandemic circumstances and limitations, the PA believes that they were to expand our teaching and learning methods with newly adjusted online activities and techniques. Most are transferable and can be blended to the foundational F2F teaching and learning methods.

- Online discussion, user testing for validation of prototypes and presentation can be adapted and applied to an online as an asynchronous peer review session;
- Annotation on screen can be more effective to engage and maintain students' attention;
- Responsive communications can reduce the distance between the instructor and student, as well as between students by;
    - further stimulating informal conversations;
    - offering a humanistic environment; and
    - feeling a sense of presence and community with each other.
- Virtual Office Hours (VOH) increased the engagement and level of questions, which students came prepared with, in addition to more students taking advantage of VOH;
- The LiveShare feature is identified as an effective method for live-coding and trouble-shooting as well as collaborative programming between students; and
- Offering virtual exhibitions provided a platform for extended student participation and interaction.

Limitations of Study

Throughout this study, we identified several variables, which include a difference in semesters; modes of teaching; background and number of students; time zones; teaching tools and resources; and expectations, assessments, learning outcomes, and teaching methods. We attempted to minimize the variables, by collecting pre-assessment data, realizing the differences and adding additional support when possible.

Further Work

The PA is currently developing two new courses, Creative Coding Lab and Web Page to Web Space.

Creative Coding Lab (CCLab) is a new foundation course that focuses on the fundamentals of computation, software design, and web technologies, through a series of creative projects. The course is intended to equip students with the skills to develop artistic and business projects that include a significant computational component. Basic topics such as variables, functions, components, and functional and reactive programming will be brought together to create interactive applications, generative art, data visualization, and other domains. Within the framework of these creative projects, students will develop a greater understanding of how computer programs operate, be exposed to various concepts used to create experiences and interactions, and become more familiar with some of the technologies that constitute the internet. This course is intended for students with no prior programming background.

Web Page to Web Space is an elective course that explores virtual interactive experience in the context of Virtual Embodiment, Visual Space and Telepresence. Students will investigate new possible ways of using the Web to create new immersive environments in a web platform, by utilizing algorithmic 3D animation and server-side programming. This is an advanced course with technically challenging concepts with three.js and node.js and suitable for students with prior knowledge in visual programming.

The PA is planning how to research teaching and learning for these courses, attending to:

1. creating activities instead of lectures by offering in-class exercises after micro lectures;
2. identifying the differences, limitations and advantages between online, blended (mixed) and in-person (F2F) modes; and
    a. There are three sections of CCLab and each section will be offered online, blended and in-person mode respectively.
3. exploring new tools for new online teaching and learning activity, such as Google Jamboard, Glitch, Mural and Miro.

REFERENCES

AbuSeileek, A. F. & Qatawneh, K. (2013). Effects of synchronous and asynchronous computer mediated communication (CMC) oral conversations on English language learners' discourse functions. Computers & Education, 62, 181–190.

Altun, A. (2008). Learner Satisfaction on Blended Learning. *E-Reader, Krakow*. Retrieved from www.academia.edu/4679620/Learner_Satisfaction_on_Blended_Learning

Berman, P., McLaughlin, M., Bass, G., Pauly, E., & Zellman, G. (1977). *Federal programs supporting educational change: Vol. VII. Factors affecting implementation and continuation* (Rep. No. R-1589/7-HEW). Santa Monica, CA: RAND. (ERIC Document Reproduction Service No. 140.

Benbunan-Fich, R., & Hiltz, S. R. (1999). Educational applications of CMCS: Solving case studies through asynchronous learning networks. *Journal of Computer-Mediated Communication, 4*(3). doi:10.1111/j.1083-6101.1999.tb00098.x

Bothum, P. (2020). A successful move to online learning. Retrieved from www.udel.edu/udaily/2020/april/success-moving-classes-online-remote-learning.

Bouhnik, D., & Marcus, T. (2006). Interaction in distance-learning courses. *Journal of the American Society Information Science and Technology, 57*(3), 299–305.

Branon, R. F., & Essex, C. (2001). Synchronous and asynchronous communication tools in distance education: A survey of instructors. *TechTrends*, *45*(1), 36-42.

Capper, J. (2001). *E-learning growth and promise for the developing world*. TechKnowLogia, Available at www.techknowlogia.org.

Casey, K. M., Shaw, E., Whittingham, J., & Gallavan, N. P. (2018). *Online teaching: Tools and techniques to achieve success with learners*. Lanham, MD, Maryland: Rowman & Littlefield.

Chiasson, K., Terras, K., & Smart, K. (2015). Faculty perceptions of moving a face-to-face course to online instruction. Journal of College Teaching & Learning, 12(4).

Cruickshank, S. (2020). How to adapt courses for online learning: A practical guide for faculty. Retrieved, from https://hub.jhu.edu/2020/03/12/how-to-teach-online-courses-coronavirus-response.

De Gagne, J. C., & Walters, K. (2009). Online teaching experience: A qualitative metasynthesis (QMS). The Merlot Journal of Online Learning and Teaching, 5 (4), 577-589.

Firat, M., Öztürk, A., Güneş, İ., Çolak, E., Beyaz, M., & Büyük, K. (2019). How e-learning engagement time affects academic achievement in e-learning environments. A large-scale study of open and distance learners. *Open Praxis, 11*(2), 129–141.

Freeman, L.A. (2013). Instructor time requirements to develop and teach online courses. Proceedings of the AIS SIG-ED IAIM 2013 Conference, 8.

Guerrero, M., & Rod, A. B. (2013). Engaging in office hours: A study of student-faculty interaction and academic performance. *Journal of Political Science Education*, 9(4), 403-416. doi:10.1080/15512169.2013.835554

Hargis, J. (2020). What is effective online teaching and learning in higher education? *Academia Letters*, Article 13.

Hargis, J. (2014). Can students learn science using the Internet? *ISTE Journal of Research on Computing in Education*, 33(4), 475-487.

Hargis, J., Yuan, Y., & Wu, T. (2020). Rapid course migration: Comparing the changes of instructor self-efficacy, Glokalde: Global and Local Distance Education Journal, 6(2), 40-57.

Hrastinski, S. (2008). Asynchronous and synchronous e-learning. Educause quarterly, 31(4), 51–55. Retrieved from https://net.educause.edu/ir/library/pdf/eqm0848.pdf

Huang, X. S., & Hsiao, E. L. (2012). Synchronous and asynchronous communication in an online environment: Faculty experiences and perceptions. *Quarterly Review of Distance Education, 13*(1), 15-30.

Jacobs, L. (2016). How constraints breed creativity. Retrieved from https://observer.com/2016/10/how-constraints-breed-creativity

Kang, M., & Im, T. (2013). Factors of learner–instructor interaction which predict perceived learning outcomes in an online learning environment. *Journal of Computer Assisted Learning, 29*, 292-301.

Krause, K., & Coates, H. (2008). Students' engagement in first-year university. *Assessment and Evaluation in Higher Education, 33*(5), 493–505.

Lewis, C., & Abdul-Hamid, H. (2006). Implementing effective online teaching practices: Voices of exemplary faculty. Innovative Higher Education, 31 (2), 83-98. doi: 10.1007/s10755-006-9010-z

Li, L., & Pitts, J. P. (2009). Does it really matter? Using virtual office hours to enhance student-faculty interaction. *Journal of Information Systems Education*, 20(2), 175-185.

Liaw, S. S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: a case study of the Blackboard system. *Computers & Education, 51*(2), 864–873.

Lillie, R. E., & Wygal, D. E. (2011). Virtual office hours (VOH) in accounting coursework: Leveraging technology to enhance an integrative learning environment. *Journal of Accounting Education*, 29(1), 1-13. doi:10.1016/j.jaccedu.2011.10.002

Lowenthal, P. R.; Dunlap, J. C., & Snelson, C. (2017). Live synchronous web meetings in asynchronous online courses: Reconceptualizing virtual office hours. *Online Learning* 21(4), 177-194.

Magnusson, T. (2013) *The Threnoscope: A Musical Work for Live-coding Performance*. https://liveprogramming.github.io/2013/papers/thor.pdf

McLean, A., Griffiths, D., Collins, N., & Wiggins, G. (2010). Visualisation of live code. *In Electronic Visualisation and the Arts London 2010*. https://slab.org/visualisation-of-live-code

Metha, R., & Zhu, M. (2016). Creating when you have less: The impact of resource scarcity on product use creativity. *Journal of Consumer Research, 42*(5), 767-78. doi: 10.1093/jcr/ucv051

Michael, K. (n.d.). Student Perceptions of Virtual Office Hours in a face-to-face undergraduate business course (pp. 197-206). ICICTE. Retrieved from www.icicte.org

Mills, S. J., Yanes, M. J., & Casebeer, C. M. (2009). Perceptions of distance learning among faculty of a college of education. Journal of Online Learning and Technology, 5 (1), 19-28.

Moawad, R.A. (2020). Online learning during the COVID- 19 pandemic and academic stress in university students. *Revista Romaneasca pentru Educatie Multidimensionala, 12*(1Sup2), 100-107. https://doi.org/10.18662/rrem/12.1sup1/252

Murphy, E., Rodríguez-Manzanares, M. A., & Barbour, M. (2011). Asynchronous and synchronous online teaching: Perspectives of Canadian high school distance education teachers. British Journal of Educational Technology, 42(4), 583–591. http://dx.doi.org/10.1111/j.1467-8535. 2010.01112.x

Nielsen, J. (1994). Usability Engineering, *Academic Press Inc*, 165.

Oppong, T. (2017). For a more creative brain, embrace constraints. Retrieved from www.inc.com/thomas-oppong/for-a-more-creative-brain-embrace-constraints.html

Rouse, M. (2014, April 25). *Troubleshooting*. WhatIs.Com. Retrieved from https://whatis.techtarget.com/definition/troubleshooting.

Sanger, C. S. (2020). Teaching intelligence: How to take your classes online. Retrieved from www.timeshighereducation.com/career/teaching-intelligence-how-take-your-classes-online

Scollon R., & Scollon, S. W. (1986). *Responsive Communication: Patterns for Making Sense Paperback*.

Skinner, E.A. & Pitzer, J.R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. InS.L. Christenson, A.L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 21-44). New York, NY:Springer.

Soosai Raj, A., Patel, J., Halverson, R., & Halverson, E. (2018). Role of Live-coding in Learning Introductory Programming, *Koli Calling '18: Proceedings of the 18th Koli Calling International Conference on Computing Education Research.*

Terenko, O., & Ogienko, O. (2020). How to teach pedagogy courses online at university in COVID-19 pandemic: Search for answers. *Revista Romaneasca pentru Educatie Multidimensionala, 12*(1Sup2), 173-179. https://doi.org/10.18662/rrem/12.1sup1/261

Wdowik, S. (n.d.). Using Virtual Office Hours to gauge the impact of transactional engagement beyond the classroom (pp. 207-217). ICICTE. Retrieved from www.icicte.org.

Wiggins, G., & McTighe, J. (1998). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development.

Zhu, E., Payette, P., & DeZure. D. (2003). An introduction to teaching online. *CRLT Occasional Papers*.

DISCOVERING MULTIPLE TRUTHS IN LITERATURE: THE KEY TO INCULCATING STUDENTS' CRITICAL THINKING SKILLS

Dushko Talevski, Elena Shalevska
Faculty of Education – Bitola, University of St. Kliment Ohridski – Bitola,
Department of English language and literature
d.talevski@hotmail.com & elena.salevska@gmail.com
ORCID no. 0000-0002-9181-0046 & 0000-0002-3270-7137

ABSTRACT
Utilizing the educational potential of literature in teaching English is an effective method of language instruction. While the primary goal of such lessons is improving the students' language skills, teachers are granted an opportunity to engage students in earnest discussions of the chosen literary composition. The secondary, yet not unimportant, goal of language lessons thus forms for purposes of preparing young malleable minds for the perils of the World's pervasive ambiguity. Attaining critical thinking skills is the process of gradually learning how to discern the veracity of various factoids, individual stories, collective events and the deliberations of separate minds. Critical thinking translates to a decision on the shape of individual truth and the consequences that arise as a result.
Literature's nature allows for multiple interpretations of a singular idea, emotion, consideration or action. The notion that reality is formed in individual minds is a central tenet in various schools of thought. Applying to that belief, reality and our perception of it is shaped by the lens through which we view it. Therefore, thorough and honest investigation of the written word may lead to different realizations of the world. Multiple interpretations gestate when thinkers apply their experiences and ideology on the same thread of words found in the pages of a book of poems or stories in prose. When confronted with a literary artwork, students must form judgments about the author's intent, the overall tone of the story, the characters' motivations and the values they express.
The journey undertaken toward the truth will vary depending on the truth-seeker. The same story will provoke different opinions in most cases. The students' individual truths will clash to a minor or major degree depending on the compatibility of their experiences. The miserable Valjean, for instance, steals a loaf of bread and forces exclamations of disgust from certain readers due to the criminality of his ways. The majority, however, consider him a hero whose morality collides with the faceless laws void of humanity. Discovering the truth in words erected for progeny is a deeply individual exercise. The beauty and soundness of the reveled truth will depend on the conviction of the seeker. Well-nurtured truths stand tall in defiance against the ambiguity that surrounds us.
Keywords: multiple truths, literature, critical thinking

1. Introduction and Background

Utilizing the educational potential of literature in teaching English is an effective method of language instruction.

While the primary goal of such lessons is improving the main English language skills, teachers can also engage students in discussions about the chosen literary piece. The secondary goal of language lessons incorporating literary forms is attaining and nurturing the students' critical thinking skills.

Literature's nature allows for multiple interpretations of a singular idea, emotion, consideration or action. The notion of reality is formed in individual minds is a central tenet in various schools of thought. Applying to that belief, reality and our perception of it is shaped by the lens through which we view it.

Therefore, thorough and honest investigations of the written word may lead to different realizations of the world. The journey undertaken towards the truth will vary depending on the truth-seeker (e.g. Valjean's experiences).

The beauty and soundness of reveled truths depend on the conviction of their seekers. Well-nurtured truths stand tall in defiance against the ambiguity that surrounds us.

1.1.Key concepts: Critical thinking

Ennis (1985) as cited in Hayes (1990) defines critical thinking as reasonable and reflective thinking which is focused on deciding what to believe or do. In the context of literature teaching in English classes, Hayes (1990) says that students are expected to make decisions on:

- different story interpretations.
- the merits of an argument.
- what is moral or immoral.
- the veracity of the information they consume.

Therefore, according to Hayes (1990), critical thinking in the framework of literature should result in:

- drawing inferences,
- making comparisons,
- determining causes and effects,
- recognizing the impact frame-of-reference has on judgment,
- judging the reliability of sources,
- spotting over-generalizations,
- distinguishing between facts and opinions and more.

Scriven and Paul (2003) as cited in Khatib, M. and Alizadeh, I. (2012) defined critical thinking as an "intellectually disciplined process in which students actively and skillfully conceptualize, apply, synthesize, and evaluate information generated by observation, experience, reflection, reasoning, and communication."

For the purposes of this study, I have constructed my own working definition, based on the aforementioned. It is as follows:

Literary critical thinking is the ability to form individual truths about the author's intent, the overall tone of the story, the characters' motivations and the values they express, which has an impact on the student comprehension and interpretation of the literary work

1.2. Key concepts: Language Skills

Another important concept to do with this paper is the concept of Language skills. Language skills are in the focus od language acquisition as teachers' around the globe try to improve their student's language abilities. There are four commonly-accepted distinction of main language skills that help learners comprehend and produce the target language:

Listening
Reading
Speaking
Writing

These are especially important in the context of ESL/EFL teaching. English as a Second Language and English as a Foreign Language are specific types of use of the English language by speakers with different native languages.

The process of teaching English in ESL/EFL setting varies as a result of the student population, teaching setting and teaching goals. ESL teaching is conducted in a country with a predominant English-speaking population while EFL is conducted in a country where English is not the dominant language.

1.3. Key concepts: Literature

As this paper's main focus is on literature and it's influence on student's critical thinking skills, one cannot go deeper into this paper's aims and objectives without defining literature in this context.

The classical (amalgam) definition (deemed incomplete by the authour of this paper) defines literature as a body of imaginative works in the form of poetry, prose and dramatic texts distinguishable by the aesthetic excellence of the execution and intention of the author.

Depending on the scope, literature can be further chategorised as:

- The entire literature of humankind
- The literature of different peoples
- The literature of individual authors

The "modern and hollistic" definitions of Literature are as follows:

> "Literature encompasses every voiced experience expressed in any form. Sermons, speeches, films, memorials, music, spoken word, comic strips all fall under the umbrella of literature. The shifting of trends resulted in the Academy awarding the Nobel Prize in literature to Bob Dylan, who is one of the most prominent cultural figures of today."

2. Methodology

This paper's aim is to qualitatively describe and assess the potential benefits of implementing literary texts in the EFL/ESL classroom with regards to improving the students' critical thinking skills

This paper will solely focus on descriptive, qualitative data that will hopefully result in better understanding of the benefits of implementing English literature in curriculum for English classes in N. Macedonia. Although a further research is expected to be conducted in the autumn of 2019, when the school year begins, this paper will focus on literature review on the benefits of literature and the multiple truths in it, in regards of developing students' critical thinking skills.

Withi this in mind, the main objectives of the further research based on this paper are as follows:

Objective 1: To examine whether or not the proposed activities motivate students to draw inferences from their past experiences?

Objective 2: To explore whether or not students started valuing and viewing literary pieces as mirrors of their own lives?

Objective 3: To examine whether or not students have become more aware of the connections between literature and life now?

Objective 4: To inspect whether or not students react to literature both logically and emotionally?

3. Results of the literature review

Chi-An and Shu-Ying (2009) conducted an in-depth study and consulted various researchers finding that literature reading nurtures critical reading since students have to:

- Recall, retrieve and reflect on their prior experiences to construct meanings of the text.
- Differentiate facts from opinions.
- Understand the literal or implied meanings and the narrator's tone.
- Locate details related to the issues.
- Find out the connections between the events or actions.
- Detect an inferential relationship from the details observed.
- Be perceptive of multiple points of views and
- Apply moral reasoning and fair-grounded judgments.

"The setting and the language of a literary work provide readers with a variety of real-world scenarios to construct meanings of self and life incrementally." "A piece of literature is a mirror of life and a world reconstructed." "By investigating into its plot, thematic development, and the interactions of the characters with others and the milieu, readers are exposed to multiple points of view and thus compelled to think and rethink their own ideas and actions." (Chi-An and Shu-Ying, 2009, p.292)

Literature's nature relates it directly to reality. One could say that literature has an even more powerful and significant role in life, because it may become the tool to criticize life (cf. Madondo, 2012).

"Critical Literacy as an approach to teaching literature develops the potentialities of each individual in such a way that the educated individual is able to make informed judgments and think critically"

"Pedagogic practices in the teaching of literature should encourage learners as future leaders to explore various sources of knowledge that would enable them to learn to reflect critically on the society in which they find themselves" (Madondo, 2012, p.34).

"Another line of argument that supports the constructive role of literature in fostering critical thinking and reading comprehension is that it invites learners into the world of problem solving. Problem solving requires analysis, synthesis and evaluation of different aspects of the same or different issues." (Khatib & Alizadeh, 2012, p.576).

"Literature among other text types is fertile with ideas to critically look at."

"Critical thinking is the cornerstone of education."

"Critical thinking prepares us not to take things for granted and to attempt to unravel the hidden agenda of texts." (Khatib, Rezaei, & Derakhshan, 2011, p.203)

"This exercise [engaging students in discussion] benefits students in two ways: firstly, it gives them an opportunity to express their own ideas about life and relationships, values and beliefs, and interests and dislikes; secondly, it

forces them to use a more complex set of structures and a more advanced range of vocabulary" ("Unit 5: Facilitating Critical Thinking through Literature", n.d).

"Students in literature classes are expected to think critically and apply their critical and analytical skills to the texts they study." (Kathib et al. 2013, p.3)

Furthermore, a recent study (Stefanova et al. 2017) found that students indeed have approached things with more advanced/developped critical thinking skills after the series of activities to do with literary texts in the EFL classroom in Spain.

3.1 Strategies for developing students' critical thinking skills

There are multiple strategies that are sure to help teachers in their endeavours to improve their students' critical thinking skills. Some of these strategies include

3.1.1. Discovering the students' current views, values, beliefs and ideologies

Knowing the student, he/she works with is an imperative for every good teacher. By knowing the students, teachers can customize their lessons in order to fit their students' unique needs. To get to know his students better, a teacher should know his students' current views, values, beliefs and ideologies. Discovering this can be done by presenting them with invoking texts and posing simple questions, such as:

- Did you like/dislike the text? Why?
- What do you think about the setting and the story?
- Which characters are your favourites? Why?
- Do you agree with the character choices?
- What would you do different?
- If you were [character name] what would you have done different?

3.1.2. Applying different critical lenses

Instructing on applying a multitude of critical lenses on a singular literary piece can be done in order to help students inhabit a variety of perspectives; interrogate beliefs and ideologies; develop the ability to read resistantly and become enlightened witnesses; discover their own truth (Beach, Appleman, Hynds, & Willhelm, 2011) Some of the critical lenses that can be applied include:

- Reader-response – Meaning constructed by readers
- Archetypal perspective – Recognizing archetypal settings, characters, themes, etc.
- Formal perspective – Paying attention to form and convention
- Psychological character perspective – Examines the internal motivations of literary characters
- Biographical perspective – The impact of the author's experiences on his/her work
- Historical Perspective – View the work in its historical and cultural context (social, political, economic, intellectual climate)
- Social class perspective – How our belonging in a certain social class affects our view of the world
- Gender perspective – How different genders view the world differently
- The deconstruction perspective – Questioning the social constructs

3.1.3. Inferring, collecting, understanding and synthetizing the various meanings of the text

This can be done through posing open-ended inferring questions to individual students or groups of students for purposes of revealing the truths hidden in a specific text. Furthermore, quoting the corresponding sections of the text and laying out the steps in the process of inferring the individual truths (meanings) can help as well.
Ultimatelly, students will be expected to collect the various truths and discuss any conflicting truths.

3.1.4. Constructing new truths through creative writing exercises

Writing excercises can help students develop their critical skills even further. Knowing this, the teacher can ask students to write the ending by providing the beginning sections of a literary piece or can ask them to create alternate endings to a given literary piece.

Infusing characters with new abilities, views and beliefs and exploring the consequences of such changes can also be done in order to encourage students to "think outside of the box"

3.1.5. Reflections on the improvement of the students critical thinking skills

Reflection and action upon it are cone of the crutial strategies that help teachers evaluate their lessons and what the students have learned in them.

By doing his own sort of qualitative evaluation of the study objectives, the teacher can discover whether or not the lessons have met the needs and whether or not he sees an improvement in the way students analyse a given literary piece in a critical manner.

4. Conclusion

Based on the foregoing, this paper concludes that there are indeed numerous benefits of implementsing Literature in ESL/EFL classes, one of which is developing students' critical skills. By proper instruction, students can be guided to discovering multiple truths in any literary piece thus becoming more critical readers themselves.

Different strategies can be employed to ensure students interact with literary text in a more critical, conscious manner. Prolonged use of such strategies will without a doubt lead to developing of their critical assessment skills.

Given the fact that in literature rarely is ever, is there an objective truth, this is considered a great way to guide students on a meaningful journey of discovering their own truth throuth the power of words.

References

Unit 5: Facilitating Critical Thinking through Literature. (n.d.). *Open Resources for English Language Teaching (ORELT) Portal.* Retrieved from http://orelt.col.org/module/unit/5-facilitating-critical-thinking-through- literature

Beach, R., Appleman, D., Hynds, S. & Willhelm, J. (2011) *Teaching literature to adolescents*. New York: Routledge.

Chi-An, T. & Shu-Ying, C. (2009). Developing Critical Thinking through Literature Reading. *Feng China Journal of Humanities and Social Science, 19,* 283- 317.

Hayes, H. W. (1990). *Critical Thinking through Literature: A Dialogue Teaching Model* (MA Dissertation). Critical and Creative Thinking Capstones Collection. 140.

Khatib, M., & Alizadeh, I. (2012). Critical Thinking Skills through Literary and Non- Literary Texts in English Classes. *International Journal of Linguistics,4*(4). doi:10.5296/ijl.v4i4.2928

Kathib, M. & Shakouri, N. (2013). *Literature stance in developing critical thinking: A pedagogical look.* International Journal of Research Studies in Language Learning. 2(4)

Khatib, M., Rezaei, S., & Derakhshan, A. (2011). Literature in EFL/ESL classroom. *English Language Teaching, 4* (1), 201-208.

Madondo, N. E. (2012). *Teaching Literature for Critical Thinking in a Secondary School* (MA Dissertation). University of KwaZulu-Natal

Stefanova, S., Bobkina, J. et al. (2017) *The Effectiveness of Teaching Critical Thinking Skills through Literature in EFL Context: A Case Study in Spain*. International Journal of Applied Linguistics and English Literature 6(6):252-266

INTEGRATION OF KEY COMPETENCES IN THE NORMAL LECTURE TURNS OF BASIC ACADEMIC STUDIES

Eckehard MÜLLER, Carolin MAS
Bochum University of Applied Sciences, Center for Teachers Education,44801 Bochum, Germany,
eckehard.mueller@hs-bochum.de, carolin.mas-mas@hs-bochum.de

ABSTRACT
Soft skills or better in Europe called key competences are essential for everyone in the working life and often stay in the shadow of traditional lectures. Because they are competences and no qualifications, the key competences must be trained in real situations. Therefore, a special situation in the lectures must be created. This paper will show without many efforts you can do it and train key competences.
With relation to the subject of the lecture (Physics, Mathematics, Economics….) you look at great persons like Newton, etc. The work is to write an application for a job of this person. Afterwards you present this application at one or group of headhunters. The headhunter could be the person, who gives the lectures on this special subject.
The experience of the model is reported, and all chances and disadvantages connected to the task will be discussed.
Keywords: soft skills, key competences, definition, portfolio

INTRODUCTION

Soft skills Key competences or often said soft skills (see next chapter) has become in the last 20 - 30 years more and more essential, because the working environment has changed and is changing. In former times you learned it step by step in the first and/or second job after the university. This situation has rapidly changed. Today the employers demand that the new employees which has no experience in the job world should also master key competences. E. g. intercultural competences are in the global working world essential for many people. Appliers for a new job are preferred, which can show personal experience. This could be studying in a foreign country for one or two semesters. Also, social work in a country far away are a proof. E. g., if somebody helps in a children's home in India before going to the university. That is a training by performance. But not all students have such a CV.

Therefore, during the academic courses of studies, the "normal" students have to get a basic idea of key competences and parallel to the traditional subjects they have to be trained to perform better in the new working world. Starting at beginning of their student life it is essential because otherwise they cannot reach the level which is demanded.

BASIC

The term key qualifications were pushed by Mertens (Mertens, 1974). But before we look at this development, some basic definitions must be made concerning knowledge, crafts and skills and on the other side qualifications and competences.

Knowledge and skills are essential components for full participation in society (OECD, 2005, p. 3). Additionally, crafts, defined as basic manual skills, must also be another component. Participation does not mean that you can work in a normal, not high sophisticated job. In this case, you need more than basic knowledge.

In the next step, qualifications are to be defined to see the differences and overlaps. One representative definition the following, which has been analogously translated: Qualifications are knowledge, skills, crafts, which should be used for special tasks or jobs. Qualifications are determined from the view of external demands and not from the view of the individual person. They are ancillary to professional competences and professional decision-making and responsibility. (The original citation is: „Unter Qualifikationen werden Fertigkeiten, Kenntnisse, Fähigkeiten und Wissensbestände im Hinblick auf ihre Verwertbarkeit für bestimmte Tätigkeiten oder Berufe verstanden. Qualifikationen werden aus der Sicht der Nachfrage und nicht aus der Sicht des Subjekts bestimmt. Sie sind den beruflichen Kompetenzen und der beruflichen Handlungskompetenz untergeordnet bzw. sind als deren integrale Bestandteile zu sehen." (Heffels, 2007)). You can say that they are embedded. This fact is schematically shown in figure 1.

The proof of qualification often is done by written tests or interviews. In the academic world, persons can gain a certificate to demonstrate a qualification like for example a diploma. But sometimes qualification can also be learned on the informal way like experience. It will be shown that a better way is to proof qualifications with practical experience.

Like you see in figure 1 competences are the outer circle, which involves all. The OECD defines competences: "A competence is more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context. For example, the ability to communicate effectively is a competency that may draw on an individual's knowledge of language, practical IT skills and attitudes towards those with whom he or she is communicating." (OECD, 2005, p. 4)

The European Commission says: "Competences are defined here as a combination of knowledge, skills and attitudes appropriate to the context. Key competences are those which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment." (EU, 2006).

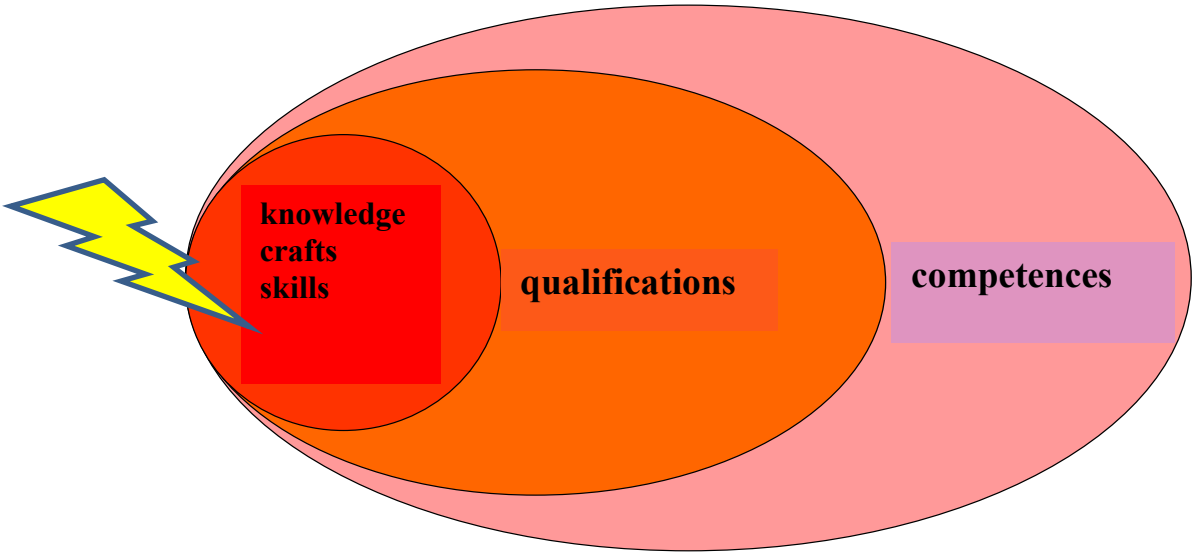
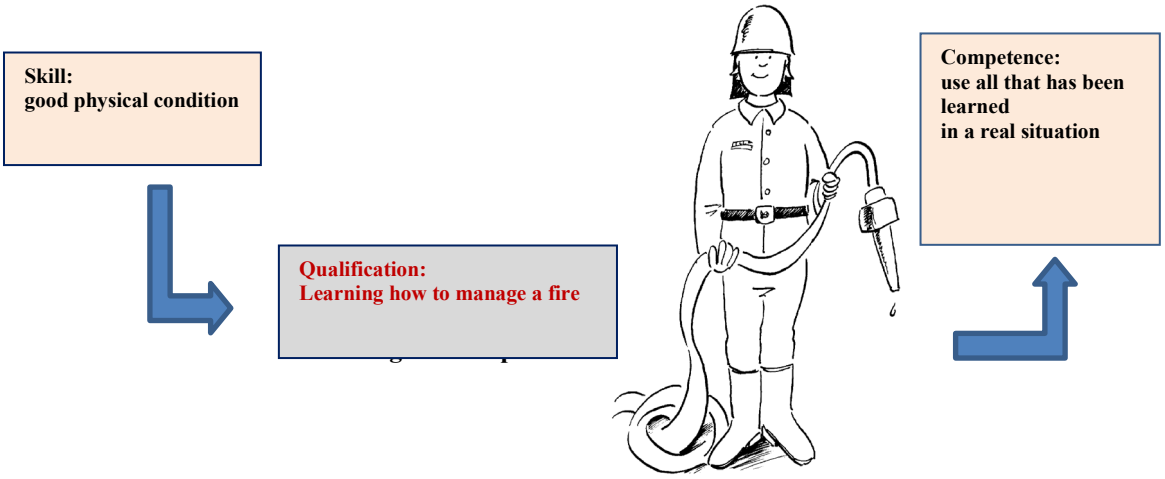


Figure 1. How the different items are embedded. (adapted from Erpenbeck, 2009)

To make it clearer a simple example of a fire brigade man is shown in figure 2.



What are the consequences for testing competences? Qualification can be tested e. g. in a written test or in a multiple-choice test, like mentioned above. As competences are a complex construct with allows a person to resolve problems successfully in variables situations (Weinert, 2002), competences must be checked in a real situation. You call it performance test. If you look at figure 2, the fireman has to show under supervision and helping in a real fire situation the acting of himself.

In the next step the contents of key competences must be defined. In the 80th decade last century in Germany the discussion about key qualifications were pushed. (Mertens, 1974) Richter (Richter, 1995) divided key qualifications into three main dimensions, which up to now you can find as the basic structure in figure 3, which show methodical competences, social competences and self-competences.

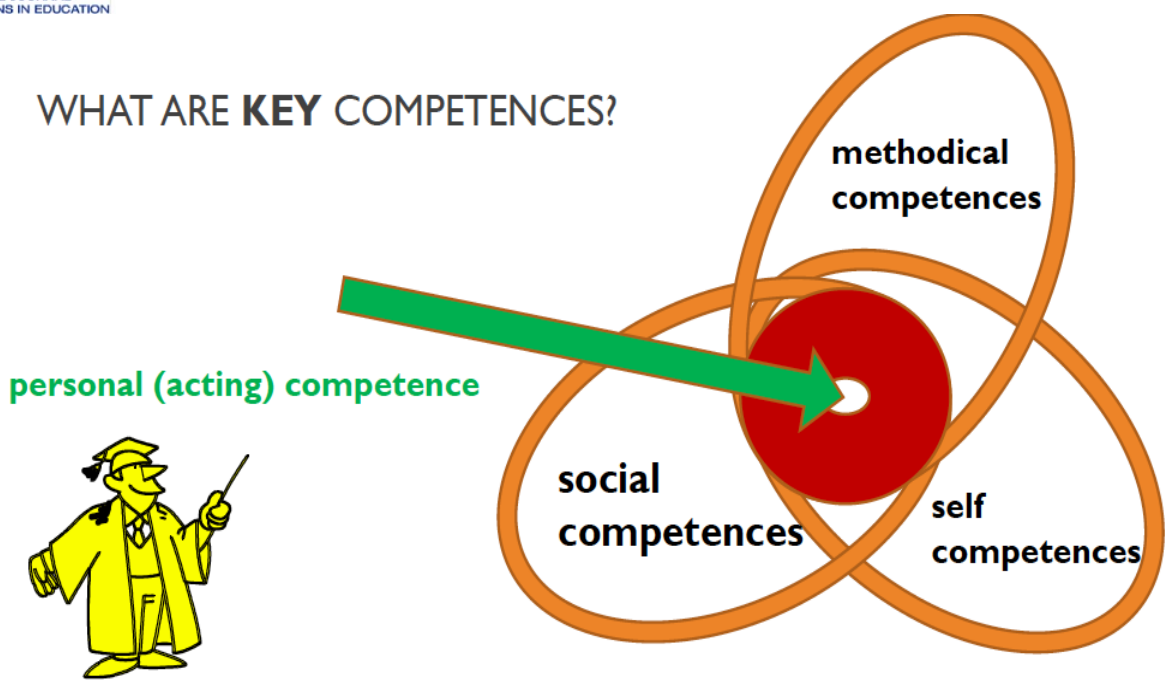


Figure 3. The basic dimensions of key competences (adapted from Richter, 1995)

What are typical key competences in the different fields? In table 1 some examples are shown. In the literature other authors expanded the fields of the competences like computing competences, competence in communication in different language, etc. (EU, 2006)), which are not further discussed here. A more expanded definition also given by the OECD in the DeSeCo Program (Defining and Selecting Competencies: Theoretical and Conceptual Foundations). (Rychen, 2000) In the international context, this definition is used very often as basic definition, because it was one of the first global definitions. In this paper the above given definitions (OECD, 2005) are used.

Some authors define key competences mostly as soft skill in a very splitted way, which may be more than 60 categories e. g. (Schulz, 2008; Taylor, 2016). This might be good in some cases, but for a basic learning step the mentioned three areas are enough.

Table 1: Examples for the different areas of key competences

competences	**methodical**	**social**	**personal**
Examples	problem solving	communication	self-conscious
	time based actioning	project-management	self-management
	presentation	team-management	motivation
	learning techniques	relation-management	stress-management

Today key competences are more important than specialized know-how of the working field. This know-how is a requirement. The lonely engineer, worker, etc. is not used anymore, because the products became so complex, that only a group or lots of smaller groups can create the product. Big software programs are a very obvious example. E. g. the right communication or project-management is essential for the success. One main part of an application to a new job is an interview one subject in a subcategory. (Cimatti, 2006) The OECD expanded the term of key competences to manage the whole life (OECD, 2005). In the future, the development will be to broader fields, which are relevant in all situations of a person. A similar classification like Richter (Richter, 1995) in this context is done by Fugate. (Fugate, 2004)

There are many possibilities to integrate key competences at the university (e. g. Abbas, 2013; Anthony, 2014; Ramlall, 2015). Mostly it is done in relation to the later job, which is a main aspect. Now an example is described which can be integrated in many subjects at schools and universities.

SPECIAL CONSIDERATIONS

The training of key competences should start in the first semester. If the students leave the university, they should be able to manage their life, especially in relation to their job. The students have an age between 18 and 22 years when they enter the university. Half of them have no working experience., which means they are coming directly from school. The other half has already a recognized occupation requiring formal training. The experience of applying for a job in the future is low. That means basic key competences have to be trained

The basic idea is that a situation is created in relation to the special subject but can be arranged in every subject. The following scenario is played:

The lecturer is a headhunter, who needs a person for a job. The students should apply for this job but in the role of a famous person of the special lecture. This situation can be done in every subject.

A list of possible persons for some subjects are shown in table 2:

Table 2: Possible persons for the tasks of the student

Subject	Physics	Mathematics	Computing	Economy
Persons	Einstein	Gauß	Zuse	von Mises
	Newton	Mandelbrot	Jobs	Mundell
	Celsius	Eratosthenes	Berners-Lee	Solow
	Planck	Laplace	Ritchie	Marx
	Bohr	Pascal	Zuckerberg	Selten
	Laue	v. Neumann	Hollerith	Hayek
	Hertz	Euler	Wozniak	Frisch

The students have to do the following steps:

1. *to choose one famous person*
2. *to write a CV of this person*
3. *to write a motivation letter*
4. *to send the letter to the head-hunter*
5. *to create a PowerPoint-presentation about the chosen CV*
6. *to participate in an application interview*

It does not matter if the famous person is dead or alive. The students must make an investigation of this person, which they have chosen. One important item is to find out the real character. This fact must be mirrored especially in the motivation letter and is essential for the interview. Of course, the headhunter (= lecturer) knows the character of the applying person. This process is an example of a performance test. Is the student afraid in the interview and you get the impression that he is shy? Or is he stammering? Or getting nervous, because the beamer drops down? And, and, and,…… You must create a special artificial and difficult scenario to simulate real life.

REALIZATION

At first, there are some additional lectures in the basics tasks like writing a letter and a CV. A special focus is made on the presentation. The real life shows e. g. at conferences, that a lot of people make boring presentations. If you are applying for a job, the headhunter has not only this one person. He has to take attention of a bunch of candidates. The strategy is to be kept in mind. One item is an impressive presentation that can be remembered within seconds. A good presentation is not enough.

One problem is the number of students. If everyone makes the whole procedure as a single person, it takes a lot of time for the lecturer. Because it is a basic step to train key competences, you can make small groups of four to six students and act like one applying candidate. In the interview, everybody has to answer questions to avoid that some are fellow runners who want to pass with a minimum of effort.

It was performed in two lectures: Physics and computing, but in different degree courses. Physics was in the course in the mechanical engineering section and computing in the course for getting a degree in computer science. In both cases it is suitable. But you could see significant differences in the students´ behaviour.

Some students from the engineering department dressed better because they recognized the situation. A lot of computing students were nerds and had no idea that the real world is working a little bit in another way. *Self-marketing* was no word in their vocabulary. Writing the CV is a method, which both groups learned and applied. In the presentation were slight differences. The engineering group generated more easily interpreted graphic images of their carrier. (Remember, it is the carrier of a great physicist.). Because all the students have not much practice standing before an audience, they behave in the same way with not much self-confidence. Organizing themselves they do without supervising and therefore difficult to evaluate.

To look back, what key competence tasks did both groups trained?

- *making a presentation (slides)*
- *presenting before an audience*
- *getting self-confidence*

- *writing a CV (application) --> lecturer*
- *organizing themselves (time)*
- *performing self-marketing*

I think it was a great experience for them. If you look realistically it was a small step into their later life.

SUMMARY

In this paper is shown to train key competences must not be combined with big efforts for the lecture. It is a general concept, which can be used in every subject or department. Also, it can be performed in bigger classes. The students are learning in the closed world within the university, which gives more self-confidence in the beginning. It is a small but maybe first step, to prepare them for their later life.

REMARK

This paper is an extended version of the presentation hold at the conference in Prag 2019, which was published in the conference proceedings. (TOJET special issue, Vol. 1 -Oct 2019). Title of the presentation: Integration of soft skills in the normal lecture turns of basic academic studies.

REFERENCES

Abbas, R., Abdul Kadir, F. A., & Ghani Azmie, I. A. (2013): *Integrating soft skills assessment through soft skills workshop program for engineering students at University of Pahang: an analysis.* International Journal of Research, In Social Science, 2(1), p. 33 – 46

Anthony, S. (2014): *Integrating soft skills in the curriculum without sacrificing content.* Journal for Academic Excellence, 2(4), p.1 - 57

Cimatti, B. (2016): *Definition, Development, Assessment of soft skills and their Rolle for the Quality of Organization and Enterprises.* International Journal for quality research, 10(1), p. 97 - 130

Erpenbeck, John (2009): Was „sind“ Kompetenzen? In Faix, W. G.; Auer, M.: *Talent. Kompetenz. Management.*, , Steinbeis-Edition Bd. 4, Stuttgart, p. 95

EU (European Union) (2006): *Recommendation of the European Parliament and of the Council L of 18 December 2006 on key competences for lifelong learning*, Official Journal of the European Union, L 394, p. 11 -18

Fugate, M., Kinicki, A. J., & Ashforth, B. E. (2004): *Employability: A psycho-social construct, its dimensions, and applications*. Journal of Vocational behavior, 65(1), p. 14 - 38

Heffels. W. M., Streffer D, Häusler, B. (2007): *Macht Bildung kompetent? Handeln aus Kompetenz – pädagogische Perspektiven*, Schriften der KFW HK, Opladen, Bd. 5, p. 53

Mertens, D. (1974): Schlüsselqualifikationen. Thesen zur Schulung für die moderne Gesellschaft. *Mitteilungen aus dem Arbeitsmarkt und Berufsforschung*, Jhg. 7, H.1, Nürnberg

OECD (2005): *The Definition and Selection of Key Competences*, https://www.oecd.org/pisa/35070367.pdf (3. July 2019)

Ramlall, S., & Ramlall, D. (2014): *The value of soft-skills in the accounting profession: Perspectives of current accounting students.* Advances in Research, 2(11), p.645 - 654.

Richter, C. (1995): *Schlüsselqualifikationen*. Sandmann-Verlag, Alling, p. 38

Rychen, D. S., Salganik,L. H. (2000): *Definition and Selection of Key Competences*, The INES Compedium, Tokyo, GA(2000)12, p. 61 - 75

Schulz, B. (2008): *The importance of soft skills: Education beyond academic knowledge. Journal of Language and Communication*, (6) 2008, p. 145 – 154

Taylor, E. (2016): *Investigating the perception of stakeholders on soft skills development of students: Evidence from South Africa*. Interdisciplinary Journal of e-Skills and Lifelong Learning, 12(1), p. 1 - 18

Weinert, F. (2002): „Vergleichende Leistungsmessung in Schulen – eine umstrittene Selbstverständlichkeit.“ In F. Weinert (Edt.): *Leistungsmessungen in Schulen*. Second Edition, Beltz-Verlag, Weinheim, p. 17 - 31

TOWARDS DIGITAL INCLUSION IN EUROPE: DESIGNING A COURSE ON SMART HOME TECHNOLOGY FOR OLDER ADULTS

Dr Alfredo Salomão Filho (corresponding author)
alfredo.salomaofilho3@mail.dcu.ie
Institute of Education, Dublin City University, 9, Drumcondra, Dublin, Ireland

Dr Trudy Corrigan
trudy.corrigan@dcu.ie
Institute of Education, Dublin City University, 9, Drumcondra, Dublin, Ireland

Dr Tanja Tillmanns
tillmanns.tanja@fh-swf.de
Department of Electrical Engineering, South Westphalia University of Applied Sciences, Lübecker Ring 2, 59494 Soest, Germany

ABSTRACT
An ageing population and an increasing life expectancy in the European continent – together with the current technological turn, favours the exploration of smart home technology and its potential to promote digital inclusion of older adults. The research draws on a European Union (EU) Erasmus + project conducted by five partner organisations from Germany, Ireland, Spain, Italy, and Romania. The study is threefold. It starts by investigating the perspectives of older adults on smart home technology and continues by assessing participants' learning preferences in relation to smart home technology. Given the Erasmus + project's overall aim to design a course on smart home technology for older adults, the study then discusses design elements to be considered when assembling a course with this purpose. The analytical framework consisted of multiple descriptive case studies generated by a survey and a focus group held in each one of the partner countries, summing 215 participants. Results indicate openness of participants towards smart home technology, despite their small familiarity with it. Data security and home security appeared as the main concern and benefit, respectively. Older adults require tailored, supportive learning experiences that address their needs and provide a space to experiment with technology.
Keywords: digital inclusion, digital skills, lifelong learning, digitalisation, smart home technology

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1. Introduction

Population ageing is coming into being as a substantial societal change (UN, 2017; WHO, 2018), especially within the European context. An increasing interest in the development of innovations through Internet of Things (IoT) systems, such as advancements in health care and engineering, have directly contributed not only to the extension of one's life expectancy, but also to a greater quality of life in these newly *added* years. While digital technologies, in a broad spectrum, offer an immense potential for increased quality of life in older age, the reality in Europe is that currently the majority of older adults are not digitally literate and/or are neither motivated nor interested in participating in the digital revolution (Friemel, 2016; Wilson, Hargreaves & Hauxwell-Baldin, 2015; 2017). Besides several e-inclusion policies, such as the digital inclusion for a better European society policy (Sovacool & Fursyzfer Del Rio, 2020), efforts from educational initiatives are required to empower citizens, especially older adults, through their embracement of technological developments.

This research is born out of a concern with the in/exclusion and (dis)empowerment and (in)equality that emerge from the rapid advancement of the digitisation of societies (Fuchs, 2015). We understand digitalisation, as defined by Kania-Lundholm & Torres (2018), as a process, not only of transition from analogue to digital, but of social transformations that this transition is bringing about. In the case of smart homes, the very concept of home is put into perspective (Sovacool & Fursyzfer Del Rio, 2020). It is our understanding that smart home technology acts a promising link between older adults and technology – where digital inclusion is seen as an effect of such link, as older adults see potential benefits in learning about, and using, smart home technology.

We draw on data generated by a European Union (EU) Erasmus + project entitled "SmartYourHome: how to make seniors' homes smarter" on digital, and lifelong, learning. Each one of the five partner organisations from the five participating countries (Germany, Ireland, Spain, Italy, and Romania) held a survey and a focus group with a sample of 215 participants in total. Description as a frame of analysis guided the design of one case study of each national context. The exploratory study is guided by three objectives. Firstly, we explore the current perspectives of older adults on smart home technology in Europe, mapping potential benefits and concerns in interacting with smart home technology in each national context. Secondly, we investigate how older adults would like to learn about smart home technology. Thirdly, we discuss – based on the elucidation of the previous objectives, some design elements of a course on smart home technology, dialoguing with the possibilities of these *new* technologies to act as promoters of 21st abilities and digital inclusion of older adults in Europe.

The article commences with the presentation of the concept of smart home technology, followed by a brief discussion on the benefits and challenges of smart home technology use by older adults – as well as their engagement in learning about technology. Furthermore, the employed methodology, methods, and analytical framework are explained. The article follows by presenting the five descriptive case studies and an analytical piece illuminating what elements can be considered to design a course on smart home technology for older adults. Lastly, the conclusion is drawn from this exploratory study.

2. Smart home: definition, benefits, challenges, and engaging older adults in learning about technology

Population ageing is a phenomenon with full capillarity: it affects us all, changing the way we perform our daily lives and moving us towards new, or newly reshaped spaces, such as the consideration of digital technologies in healthcare, retirement, housing, and mobility (Tse, Choi & Leung, 2008). It is within some of these spaces that smart home technologies and their "eldercare capabilities" (Kelly, McLoone & Dishongh, 2009) are acquiring more relevance, consolidating as an object of study, and bringing professionals of the most diverse areas of knowledge together to think of, and about, innovative technological solutions to smart living. Analysing the infrastructure requirements for the installation of smart homes, Kelly et al. (2009) contemplate that these technologies will soon be integrated into the design of future houses: "it is a question of "when" rather than "if" (p.221). In this study, our primary concern focuses on the potential brought by smart homes to engage older adults in technology (and learning about technology), hence fostering digital inclusion.

2.1 What is a smart home?

Drawing on Chan, Esteve, Escriba, & Campo (2008), Balta-Ozkan, Davidson, Bicket & Whitmarsh (2013, p.364) define smart home as "a residence equipped with a high-tech network, linking sensors and domestic devices, appliances, and features that can be remotely monitored, accessed or controlled, providing services that respond to the needs of its inhabitants". Smart home technology is usually applied to security (cameras, locks), entertainment (television, voice assistants), energy efficiency (through optimal electricity consumption), comfort (windows and blinds managed automatically) and health support (devices that monitor the health conditions of the user, allowing information to be shared with doctors and/or family members). The distinction of smart home "device" and "service" is beneficial under the smart home thematic. Balta-Ozkan et al. (2013) classify "smart home services" as the benefits "smart home devices" offer to users. What differentiates smart home from "simply high tech-equipped residence (…) is the network, through which each of the technological components and information about them is connected and coordinated" (ibid p.364). IoT is an emerging paradigm, connecting objects or *things*, such as smart home devices, to each other, to the internet, and to users (Ali & Awad, 2018). Sovacool & Fursyzfer Del Rio (2020) concluded that moving beyond analogue home requires engagement with multiple levels of "smartness". They defined the various levels of smartness within smart home technologies, as summarised in Table 1 below.

Level title	**Level description**
Level 0 – Basic	The basic analogue home without any smart home technology
Level 1 – Isolated	A home with some isolated smart technologies (e.g. baby monitor or TV)
Level 2 – Bundled	Smart technologies become bundled and programmable (e.g. heat and appliances)
Level 3 – Automated	Smart home technologies become programmable, more automated and anticipatory
Level 4 – Intuitive	Systems integrate to learn, modify, and adapt provision of many services
Level 5 – Sentient	Systems fully integrate and automate to meet all predicted needs
Level 6 – Aggregation	Intuitive or Sentient smart homes become interconnected into

	neighbourhoods, cities, and states

Table 1. Levels of smartness with smart home technologies (adapted from Sovacool & Fursyzfer Del Rio, 2020, p. 7).

2.2 The benefits and challenges of smart home technology use

The engagement with smart homes is prioritised in EU policies towards a digitally inclusive society as well as in relation to strategic energy planning, climate change, sustainable architecture, and building construction management (Sovacool & Furszyfer Del Rio, 2020; EC, 2015; Wilson et al. 2017). In the context of older adults, smart home technology offers a possibility to enhance home care. It enables users to become more independent, positively contributing to their health and well-being. Smart environments may also prevent social isolation, as residences can share the user's data with others, such as in a health emergency. There is a consensus on the relationship between smart home technology use and quality of life improvement (Chan, Campo, Estève & Fourniols, 2009; Flores-Martin, Pérez-Vereda, Berrocal, Canal, & Murillo, 2019; Kelly et al. 2009; Laver, George, Ratcliffe & Crotty, 2011).

Yet, through the analysis of expert views and public attitudes, Balta-Ozkan et al. (2013) explored social barriers to the adoption of smart homes. They concluded that the main barriers are control (over systems and devices), security (data and home), and cost (acquisition and maintenance). Older adults lack engagement with technological advancements and tend to have data security and privacy concerns (Sovacool & Furszyfer Del Rio, 2020; Wilson et al. 2015). As progressively more data is collected by, and exchanged among, IoT objects, issues of confidentiality, authenticity, and integrity preoccupy users (Ali & Awad, 2018).

2.3 Engaging older adults in learning about technology

Wilson et al. (2017) conducted a content analysis of smart home technology marketing material and concluded that the industry is not investing in building consumer confidence. Marketing experts perceive education as vital in helping consumers to be ready for interconnected homes (Twice, 2019). Similarly, González-Oñate, Fanjul-Peyró, & Cabezuelo-Lorenzo (2015) examined the preparedness and interest of the European ageing society to deal with new technologies. Using a survey in UK, Spain, and France, the study concluded that older adults can adapt to new technologies through Information and Communications Technology (ICT) education and training. This implies the responsibility education has to equip older adults with digital skills, therefore enabling digital inclusion.

Mooij, Steffens & Andrade (2014) exemplifies three different models of ICT–based learning, ranging from "traditional" via "more flexible" to "optimal" learning. Chaffin & Harlow (2005) also conceptualised a model demonstrating the learning process of older adults to acquire computer skills. They emphasise that the key interests of the learner should be identified, followed by thoughtful preparation of the material by the educator, which in turn would result in student motivation (Chaffin & Harlow, 2005). Advancing on Davis' (1985; 1989; 1993) Technology Acceptance Model (TAM), Dogruel, Joeckel & Bowman (2015) developed an "expanded Technological Acceptance Model" (eTAM) for older adults that considers other variables apart from the perceived ease of use (PEOU) and perceived usefulness (PU) as the original TAM framework suggests. Additional predictor variables for older adults are: system use (such as technophobia) self-efficacy, previous experience, and expertise with media technology. Their conclusions suggest that older adults can learn to use and enjoy technology only if they feel they can handle it. The next section discusses the methodological steps of the study.

3. The Study

3.1 Context and Purpose

This exploratory study draws on an EU Erasmus + project entitled "SmartYourHome: how to make seniors' homes smarter" – executed by a research consortium formed by five partner organisations from five countries: Germany, Ireland, Spain, Italy, and Romania. The focus of the investigation is threefold. *First*, we explore the current perspectives of older adults on smart home technology, mapping potential benefits from, and challenges in, interacting with smart home technology in each national context. *Second*, we investigate how older adults would like to learn about smart home technology. *Third*, based on the previous investigative efforts, we discuss the design elements of a timely course on smart home technology, a task envisaged to be conducted posteriorly by the *SmartYourHome* research consortium. In what follows, we discuss *case study* as the selected methodology, followed by the appraisal of the research methods used: *survey* and *focus group*.

3.2 Methodological & Analytical Framework: Multiple, Descriptive Case Studies

Case studies are largely used in qualitative inquiry, being defined in multiple ways (Blatter, 2008). They allow the researcher to focus on a case of interest, its context, and its complexity (Mabry, 2008). Whether a bounded system (Stake, 2005), a research strategy (Hartley, 2004), or an empirical investigation (Mabry 2008), case studies are usually rich in data (ibid). The methodology employed in this study consists of multiple qualitative case studies (Yin, 2018). The data generated by the surveys and focus groups informed the writing up of a descriptive case study of each of the five participating countries in the project. Axiologically, a more objective perspective was applied to report and explanate the meanings, experiences, and the reality of research participants.

A multiple case study methodology may consist of multiple individual cases, that once assembled, provide an overview of a broader context. The data generated for the study was analysed in light of Wolcott's (1994) elaboration of *progressive focusing:* a tool to "reveal" a descriptive account. Progressive focusing refers to the act of "zooming": *in* and *out*. We zoom *in* five different national contexts in all their particularities, as well as zooming *out* to elucidate our object of study more broadly. Considering the explorative nature of the research and following Wolcott's (1994) elaborations, the focus on description as a way to transform qualitative data is warranted by the treatment of descriptive data as facts that "speak for themselves" (Wolcott, 1994, p.10), which is facilitated by the establishment of pre-determined themes prior to data generation. As description and analysis are not mutually exclusive, we debate on the possibilities to design a course on smart home technology for older adults having the content previously displayed of the descriptive data (case studies) as an analytical guide. Figure 1 below shows the analytical framework of the study.

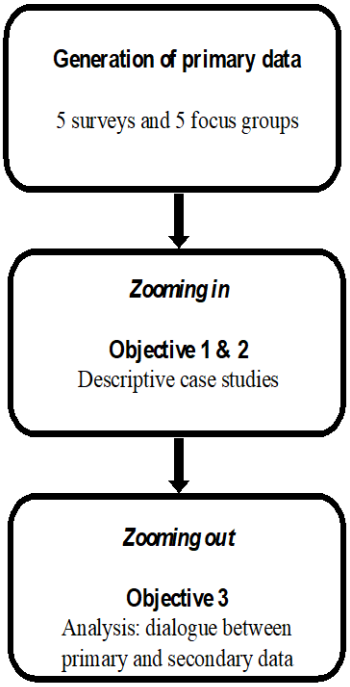

Figure 1. Analytical Framework of the study (designed by the authors).

The descriptive case studies followed a structure based on pre-determined themes, as follows:

Objective 1: investigate the perspectives of older adults on smart home technology

- Country's Context (demographics and internet use)
- Self-assessment on digital skills
- Current knowledge of smart home technology
- Imagined benefits emerging from the use of smart home technology
- Concerns associated with the use of smart home technology

Objective 2: investigate the perspectives of older adults on learning about smart home technology

- Learning preferences on smart home technology
- Amount of weekly time one would invest in smart home technology learning
- Interest to become an e-tutor of a course on smart home technology

Posteriorly to the case studies (zooming in), we focus on answering *Objective 3* of the study (zooming out): establishing a dialogue on the possibilities of designing a course on smart home technology for older adults.

3.3 Methods & Sample

This study made use of surveys and focus groups that inform each of the five descriptive case studies. A set of triangulation strategies, such as utilising different data sources and methods, were implemented in order to enhance the study's robustness and trustworthiness (Flick, 2002). We, the authors, remained objective and transparent during the conduction of the research, albeit aware that both researchers and participants are inevitably influenced by the subjective, multi-faceted qualitative research process itself.

First, each partner country conducted a *survey* – a total of 5 surveys with 176 participants: Ireland (n=20), Germany (n=24), Italy (n=29), Spain (n=80), and Romania (n=23), noting that Spanish participants constituted almost half of the survey sample. Posteriorly, each partner country held a *focus group*: a total of 5 focus groups with 39 participants: Ireland (n=11), Germany (n=7) Italy (n=9), Spain (n=8), Romania (n=4). Considering both research methods employed, a total of 215 older adults participated in the study. This research obtained approval from Dublin City University's ethics committee, being conducted in light of its ethical research guidelines in force. In what follows, we describe the specificities of the research process within the scope of each of the research methods employed.

Following the World's Health Organization fluid understanding of ageing, where "decrease in physical and mental capacity" would not necessarily imply linearity (WHO, 2018), we considered people over the age of 40 (regardless of their level of digital skills) as suitable survey participants. 67% of survey participants were over 60 years old. Table 2 shows the age range of the survey participants from each country.

Age range	Germany	Romania	Spain	Italy	Ireland	Total
40–50	1	1	4	1	4	11
51–60	13	13	6	3	10	45
61–70	8	7	37	11	3	66
71– 80	1	2	30	13	3	49
81–90			3			3
Undisclosed	1			1		2
Total of Participants	24	23	80	29	20	176

Table 2. Age Range of Survey Participants.

We recruited participants via convenience sampling, which allowed us to explore the potential of our networks of acquaintances. Members of the education and training community, including former university students as well as members of social organisations for older adults were invited via email to take part in the study. The application of snowballing sampling techniques complemented the recruitment phase (Waters, 2015).

The survey was carried through SurveyMonkey. The survey questionnaire covered the following areas: demographics, level of digital skills, current knowledge on smart home technology, expected benefits of the technology, and concerns in relation to the use of the technology. The questionnaire also assessed the preferred method of learning about smart homes, the amount of weekly time one would invest in learning, and the interest to act as an e-tutor for the course on smart home technology to be designed by the *SmartYourHome* research consortium in the near future.

Subsequently to the survey, all 5 partner countries held a focus group of approximately 1–hour duration. Similar to the survey procedures, focus group participants were recruited by convenience and snowballing sampling. Table 3 displays the information about the age range of focus group participants in each partner country.

	Germany	**Romania**	**Spain**	**Italy**	**Ireland**	**Total**
Number of Participants	7	4	8	9	11	39
Participants' Age Range	60–80	50–60	60–80	51–75	60–80	

Table 3. Age range of focus group participants.

A semi-structured guide was applied to the focus groups, where the focal point of the investigation did not differ to the survey. However, given the discursive nature of focus groups – or "collective conversations" (Kamberelis & Dimitriadis, 2005, p.887) – participants had the opportunity to elaborate further in emerging themes, voicing their opinions and concerns on smart home technology more comprehensively.

Although the research consciously adopted an exploratory stance, aiming at executing a two-phased mapping of a thus far incipiently explored terrain, the number of recruited participants appears as a limitation of the study if one considers issues of representativeness and generalisability. We display the five case studies in the next section.

4. Zooming in: descriptive case studies

This section presents the descriptive case studies on smart home technology in Germany, Ireland, Spain, Italy, and Romania, as follows.

4.1 Germany

With a population over 80 million people, 38.73 % of Germans are over 55 years old with a life expectancy of 81,1 years (CIA, 2020). 48% of 55-74 years-old individuals have basic or above basic overall digital skills (Eurostat, 2020).

Overall, German participants of this study were familiar with basic technology. 75% of survey participants (n=24) consider themselves as an advanced or expert user, while all focus group participants (n=7) use computers and smartphones on a daily basis with no help required. Assessing the survey sample's current knowledge of smart home technology, 66% know what smart home means and 21% have used a smart device. In the focus group, all participants were familiar with at least one smart home device (cameras and/or voice assistants).

Answering to an open question, survey participants pointed out the following expected benefits from smart home technology:

- Home security (15 participants)
- Living in one's own home for longer in old age (10 participants)
- Simpler, cheaper life (9 participants)
- Comfort (4 participants),
- Energy saving (3 participants)
- Control /automation of processes (2 participants)

From the survey results, security and a self-determined life in older age were elected as the most important positive factors of such technology, which was also confirmed in the focus group. In addition, focus group

participants discussed health related benefits of smart home technology, such as recognition of accidents, recognition of unusual behaviour, and health-monitoring. Besides home security, health benefits were pointed out as the most valuable aspects of smart home technology, followed by comfort, and energy saving. Focus group participants also pointed out that devices should be designed in a way that allows older adults to use them independently, perceiving smart home appliances as helpful in their daily lives.

In the form of an open survey question, the mentioned concerns in relation to smart home technology are, as follows:

- Data protection (13 participants)
- User-friendliness (10 participants)
- Lack of reliability of technical component or power failure (7 participants)
- Trust (6 participants)
- Costs (5 participants)

For the survey participants, data protection and ease of use of smart home technology are pointed out as the biggest concerns. This was also echoed in the focus group. Topics of hacking and data protection emerged under the broader discussion of concerns over smart home technology. Participants reminded on different hacking scandals reported by the media and wondered if it was even possible to protect such appliances in a way that no one else could access them. All focus group participants agreed that there is a wide range of smart home appliances, but there remains a concern on the kinds of devices and services that will solidly facilitate daily life in the future. Yet, according to the participants, not all appliances are as useful as they might seem at first glance.

As to learning about smart home technology and with the six below alternatives provided, survey participants could select more than one alternative in this question. They would prefer a blended delivery mode to learning: a combination of several analogue and digital elements.

- Intergenerational learning (2 participants)
- Video (2 participants)
- Textbook (6 participants)
- Face-to-face/in-group learning (7 participants)
- Online courses (6 participants)
- A mix of all of the above (14 participants)

Over two thirds of the survey participants would prefer to spend between 1-4 hours per week learning about smart home technology. The focus group discussion illuminated an interest from the participants to know more about data protection and to understand how smart-home technology works – and why it is possible to be hacked.

German older adults have an interest and openness towards smart home technology which is also represented by the fact that more than half of survey participants (54.5%) are willing to become an e-tutor for a course about smart home technology. Overall, German older adults would find smart home technology helpful if it is simple, understandable, and safe.

4.2 Ireland

Ireland has more than 5 million inhabitants with 24,59% of the population over 55 years and a life expectancy at birth of 81,2 years (CIA, 2020). 29% of 55-74 years-old individuals have basic or above basic overall digital skills (Eurostat, 2020).

Survey participants (n=20) were familiar with basic technology with 80% considering themselves as an advanced or expert user. Focus group participants (n=11) use computers and smartphones on a daily basis. When asked whether they would need any particular help with the use of technological devices, focus group participants stated that overall no assistance would be needed but they would eventually obtain help from their "kids". 70% of survey participants know what smart home means and 20% have used a smart device. Only a minority (n=2) of focus group participants make use of some smart home devices, such as voice assistants.
Survey participants were asked to state the areas where smart home technology could bring benefits, as follows:

- Home security (7 participants)
- Lower energy costs (5 participants)

- Increased communication for those who may be isolated (2 participants)
- Convenience (2 participants)
- Better time utilisation (1 participant)
- Ease of access to services (1 participant)
- A longer and less stressful life (1 participant)
- Health care (1 participant)

In the focus group, the discussion on the benefits focused on control over personal environment, flexibility, and energy efficiency. Other main factors that would motivate one to make one's home smarter are security, comfort and independent living. Those benefits were associated with the use of smart devices, such as doorbells, lights, alarm systems, and cameras. One participant concluded that: "security brings comfort; and security is an issue for everybody, not only for the elderly". Despite their initial lack of familiarity with smart home concepts, participants were progressively developing their perspectives on this technology and the possibilities it brings to its users. As one participant puts it: "(…) smart homes…it's way over my head, but it's not too bad".

In the Irish survey, the main concerns in relation to smart home technology are, as follows:

- Data security (5 participants)
- Savings (3 participants)
- Preoccupation with installation and maintenance costs (2 participants)
- Trust (2 participants)
- Overdependence on technology (2 participants)
- Usability (2 participants)
- Low digital skills (2 participants)
- Stress (1 participant)

As in the survey, focus group participants were mainly concerned with their privacy and data security, including fear of hacking and data protection issues. One participant referred to "Alexa", raising concerns whether the device collects information without users' awareness. Preoccupations with installation and maintenance costs of smart home devices were also mentioned. One focus group participant highlighted his lack of trust in technology: "(…) the other day I was in the middle of nowhere and my car keys didn't work because of the battery, and there is no place to turn the car on…this is technology that backfires".

The majority of survey participants would prefer to learn about smart home technology via blended delivery mode, as follows:

- Textbook: (0 participant)
- Face-to-face/in-group learning (1 participant)
- Intergenerational learning (1 participant)
- Video format (2 participants)
- Online courses (5 participants)
- A mix of all of the above (10 participants)

In terms of the number of weekly hours dedicated to learning about smart homes, more than three quarters of the participants would be willing to dedicate 1-4 hours. Over 75% of survey participants were interested to becoming an e-tutor in a future *SmartYourHome* course.

Overall, Irish respondents "find the idea [of smart home technology] a little scary", and simultaneously described it as "progressive and beneficial" and "the way forward for our future". As one survey participant writes, "poor digital literacy, however, may hinder or limit the take-up of this initiative".

4.3 Spain

Spain's population is over 50 million people, of which 31,48 % are over 55 years old with an average life expectancy at birth of 82 years (CIA, 2020). 31% of 55-74 years-old individuals have basic or above basic overall digital skills (Eurostat, 2020).

The survey sample (n=80) was divided in terms of self-assessment of their digital skills. 65% of participants considered themselves as "beginners" and 31.2% as "advanced". All participants (survey and focus group) have

experience with smartphone and computer use. The focus group (n=8) revealed that older adults use smartphones on a daily basis and most of them use a computer regularly. Assessing the survey's sample current knowledge of smart home technology, 55% of survey participants know what smart home means and 14% have used a smart device.

Participants are confident with messaging and social network use, which they regularly do, and to that which they are taught, normally by a son or daughter. However, all focus group participants emphasised caution when using either the internet or apps, being careful with the websites they access. Most participants stated that technology is a relatively recent phenomenon: "it was not part of our professional lives, and it got us too old to learn efficiently".

The most mentioned expected benefits of smart home technology in Spain are, as follows:

- Home security (22 participants)
- Assistance (19 participants)
- Energy cost savings (16 participants)
- Comfort (6 participants)
- Home entertainment (3 participants)
- Quality of life (3 participants)
- Connectivity with others (2 participants)

Those expected benefits were also evident in the focus group. Besides enhancing home security, Spanish participants noted that smart home technology could prolong their life at home, as it reduces "tedious housework", and increases mobility and safety at home. Focus group participants also discussed the aspect of energy consumption and how smart home technologies could lessen the human impact on the environment.

Most survey participants are most concerned with cost, usability, and data security, as exposed below:

- Cost (31 participants)
- Complexity of the technology (27 participants)
- Data security (21 participants)
- Overdependence on technology (3 participants)
- Reliability (2 participants)

In the beginning of the discussion, focus group participants were unsure whether they could need a smart home and could not imagine how it would help to improve their lives in terms of safety and care. Although privacy was raised as a major concern, a few participants would feel comfortable with the technology as long as the service provider assured them it is safe. Another main concern mentioned refers to the price of smart home technology as too high. During the focus group, all participants claimed that technology is not so easy to learn and "can get too complicated if you want to do anything more than a few basic things". Participants agreed that "old technology is more reliable and easier to use than new one". Ultimately, as the conversation progressed, most participants expressed willingness to engage with smart home services if the benefits were clear to them and if their data was secure.

Survey participants indicated their preference to learn about smart home technology through face-to-face encounters, as follows:

- Textbook (no participant)
- Video format (no participant)
- Online courses (10 participants)
- Intergenerational learning (10 participants)
- Face-to-face/in-group learning (49 participants)
- Mix of all of the above: (30 participants)

Over 80% of Spanish survey participants indicated they would like to spend between 1-4 hours per week learning about smart home technology. Spanish participants are sceptical but openness towards learning about smart home technology also occurred: 18.75% of survey participants expressed their interest in becoming an e-tutor for the *SmartYourHome* course.

4.4 Italy

Italy has more than 62 million citizens of which 36.08% are over 55 years with a life expectancy at birth of 82.5 years (CIA, 2020). 23% of 55-74 years-old individuals have basic or above basic overall digital skills (Eurostat, 2020).

More than 75% of survey participants (n= 29) were at a beginner level of digital skills. All focus group participants (n=9) owned a mobile phone and had a computer at home. Focus group participants stated that they use phones more frequently than the computer. Albeit the need for assistance is rare, they eventually ask "younger family members or friends for support". Referring more specifically to smart home technology, 65,5% of survey participants know what smart home means and 6,9% have used a smart home device. These results are also mirrored in the focus group. The majority of participants were not familiar with smart home technology. One participant knew Google Home and Alexa, which when mentioned, was then considered as "convenient to have" by the other participants.

The majority of survey participants expected smart home technology to be beneficial within the following areas:

- Home security (22 participants)
- Comfortable living (14 participants)
- Easy day-to-day support (14 participants)
- Simplification of life (2 participants)
- Entertainment (2 participants)

Those benefits were also discussed in the focus group, suggesting that security and independence at home are expected from smart home technology use. Overall, focus group participants showed interest in smart home devices, displaying willingness to install them in their homes at some point if convenient. A few participants highlighted the comfort and safety deriving from automation and distant controlling devices of doors, windows and gates in their homes One participant was "enthusiastic to own those devices but the setup and installation needed to be done by a technician or a more IT skilled person, maybe a family member or friend".

Survey participants raised concern over the following aspects in relation to smart home technology:

- Cost of acquisition (29 participants)
- Data security (29 participants)
- Usability (2 participants)

As to the focus group, participants showed that lack of digital skills was their main concern. Several participants stated that they would not be able to use the devices correctly due to their lack of technological knowledge. Moreover, a discussion over losing autonomy given technological developments was held in the focus group: As one participant puts it: "I'm afraid of losing autonomy and ability to do things (…) and to become too dependent on the important support and help provided by the home once it was made smart".

The survey suggests that participants preferred to learn about smart home technology from online courses, as follows:

- Face-to-face / in group learning (no participant)
- Intergenerational learning (4 participants)
- Video (5 participants)
- Textbook (12 participants)
- Online courses (18 participants)
- A mix of all above (no participant)

As to future engagement with the technology, 70% of survey participants would be willing to invest 1-4 hours per week learning about smart home technology. Overall, focus group participants were curious to get more knowledgeable about smart home technology towards the end of the session. They expressed an interest in learning "how to use the devices". This curiosity and openness to learning was also reflected in 70% of survey participants being interested to become an e-tutor in future *SmartYourHome* initiatives.

4.5 Romania

Romania has more than 21 million citizens. 29,31 % are over 55 with a life expectancy at birth of 76 years (CIA, 2020). 13% of 55-74 years-old individuals have basic or above basic overall digital skills (Eurostat, 2020).

77% of survey participants (n=23) assess themselves as beginners regarding their level of digital skills, where 41% of participants know what smart home means, and 9% have used smart home products. All focus group participants (n=9) confirmed to have wireless internet in their home, using it daily. The majority however had never heard of the term smart home. One participant had an idea what a smart home could be as he had used "smart home products".

The most mentioned expected benefits of smart home technology in the Romanian survey are, as follows:

- Home security (10 participants)
- Health assistance (independent life) (8 participants)
- Energy cost savings (5 participants)
- More free time (1 participant)

These benefits were also discussed in the focus group, suggesting that security and independence at home are the expected benefits of this technology for the participants. All participants highlighted independence as an important aspect of their lives, where smart home devices may be "useful" for such purpose.

The concerns emerging from the use of smart home technology extracted from the Romanian survey results are, as follows:

- Costs (11 participants)
- Utility (9 participants)
- Trust and confidentiality (3 participants)

The discussion of concerns during the focus group in Romania resulted in an increased curiosity from the participants in smart home technology. Rather than pointing out possible concerns from the use of these technologies given their unfamiliarity with the subject, participants raised a few questions, such as: "how complicated is to use the devices? How much do they cost? Do I have to pay monthly instalments or only at the moment of purchase? Where are such devices available for sale?".
The survey shows that older Romanians preferred "face-to-face/in group learning" in relation to the learning approach to smart home technology, as follows:

- Textbook (1 participant)
- Video (1 participant)
- Intergenerational learning (4 participants)
- Online courses (6 participants)
- Face-to-face/in group learning (9 participants)
- A mix of all of the above (4 participants)

When the discussion of learning preferences was brought to the focus group, participants agreed that "it is easier to understand the content when attending a face to face meeting, rather than watching videos or attending online courses". The explanation for preferring this method lies in their lack of comprehension of "these modern terms that are used nowadays", which would require clarification. As one participant exemplifies: "I will buy a new device and it will remain unopened until one of my children will have time to help install it". 72% of the survey sample would like to invest 1-4 hours per week learning about smart home devices, while 14% expressed their interest in being an e-tutor in a smart home course.

5. Zooming out: discussion

5.1 Overview of descriptive case studies

We provide Table 4 below with the key findings of all the case studies in order to facilitate the reader's visualisation of our analytical efforts to "zoom out" the data.

	Germany	Ireland	Spain	Italy	Romania
Level of digital skills	Majority are advanced/ expert users	Majority are advanced/expert users	Majority are beginners	Majority are beginners	Majority are beginners
Knowledge and experience with smart home technology	66% know what it is; 21% have used smart home technologies	70% know what it is; 20% have used smart home technologies	55% know what it is; 14% have used smart home technologies	65,5% know what it is; 6,9% have used smart home technologies	41% know what it is; 9% have used smart home technologies
Expected benefits	Home security; Living in one's own home for longer in old age; Simpler, cheaper life; Comfort; Enhanced health care	Home security; Lower energy costs; Increased communication for isolated individuals; Convenience; Better time utilisation; Ease of access to services; A longer and less stressful life; Control; Enhanced health care	Home security; Independency; Energy cost savings; Comfort; Home entertainment; Quality of life; Connectivity with others	Home security; Comfortable living; Easy day-to-day support; Simplification of life; Entertainment; Independence	Home security; Independence; Energy cost savings; More free time; Enhanced health care
Concerns	Data security; User-friendliness; Reliability; Trust; Costs	Data security; Savings; Preoccupation with installation and maintenance costs; Trust; Overdependence on technology; Usability; Low digital skills; Stress	Costs; Complexity of the technology; Data security; Overdependence on technology; Reliability	Cost of acquisition; Data security; Usability; Low digital skills; Overdependence on technology	Costs; Utility; Trust; Data security
Preferred delivery mode	Blended	Blended	Face-to-face/in-group learning	Online learning	Face-to-face/in-group learning
Preferred hours per week to learn	1-4 hours	1-4 hours	1-4 hours	1-4 hours	1-4 hours
Interest to be an e-tutor	Over half would be interested (55.4%)	Majority would be interested (75%)	Some would be interested (18.75%)	Majority would be interested (70%)	Some would be interested (14%)

Table 4. Overview of Case Studies.

One way to address digital inclusion is to increase the engagement of the European ageing society with new technologies. This study set out to explore learners' perspectives on smart home technology before designing a course for older adults on the subject. From the findings summarised in Table 4, we observe the differences in the level of digital skills and in the degree of familiarity with smart home technologies within Europe. Irish and German participants had more experience with such technologies than participants in Spain, Italy, and Romania. Participants with lack of experience with smart home technologies would also tend to have lower digital skills. In addition, countries with more participants with beginner level of digital skills prefer analogue learning methods. However, the findings of Italy demonstrate that older adults with beginner level of digital skills could also be interested in online learning, which may also be related to the fact that overall participants of this study were internet users. Participating countries with more advanced digital skills would have more participants

interested to become an e-tutor, with Italy as an exception. Overall, the findings suggest that a course should be within the range of 1-4 weekly learning hours.

For the participants across all the five nations, the main benefits of smart home technologies are a safer, more autonomous, and more independent life at home. Main concerns of participants are data security, costs of installation and maintenance, and the usability of smart home technologies. Moreover, motivational indifference (perceived uselessness) or deficient knowledge of digital advancements (Friemel, 2016) are a concern for older adults to engage with smart home technologies. For example, in Romania, participants had little prior knowledge about smart homes. Consequently, they could not draw any expected benefits from smart home technology before taking part in the research. When participants however were introduced to potential benefits of the technology in the focus group, we observed their increased interest in the subject. As indicated by Hernández-Encuentra, Pousada & Gómez-Zúniga (2009), older adults should know the function of the technological device beforehand and should be confident that the technology ensures their independence and autonomy. They point out that attitudes, experience of use, and perceived benefits should be considered when teaching digital skills to older adults.

5.2 Discussing the design of a smart home technology course for older adults

The future *SmartYourHome* course is one medium in which older adults can empower themselves, therefore participating in the digital society. The identified benefits of, and concerns about, the technology offer insights for the curriculum of a course on the subject. The main benefits suggest that a course should inform how smart home technologies can make a home safer and more autonomous, and the areas in which technological options are currently available. Here, the usability of smart home technologies should be emphasised to address the perceived uselessness (Friemel, 2016), evident across the sample. The main concerns of the participants in this study suggest that the course should also cover data security, and ways to improve deficient knowledge of digital advancements (Friemel, 2016), for example, by learning where to find news and information about maintenance and costs of smart home technology. The learning objectives of a course about smart home technology should be tailored to the adequate level of "smartness" (see Table 1 – Sovacool & Fursyzfer Del Rio, 2020) of the given cohort of older learners. The national contexts offer further guidance to identify learning outcomes, equipping older adults to move onto the next level of smartness in smart home technology.

The findings of this study and the surveyed literature suggest a few issues to consider when designing courses about smart home technologies for older adults: (1) self-efficacy; (2) past learning experience, (3) learning preferences, and (4) current ICT skills.

(1) In spite of contextual asymmetries, the lack of self-efficacy was evident in all five case studies. Self-efficacy, one's belief in their capability to perform a course of action when dealing with a given situation (Bandura, 1997), was highlighted as an important predictor of the pleasant use of ICT's (Dogruelet al., 2015). In all countries, participants emphasised "userfriendliness/usability/complexity/utility of smart home technology as a major concern. This confirms findings by Hernández-Encuentra et al (2009), noting that older adults may perceive a "lack of usefulness (of technology) in everyday life" (p.227). Several studies have related self-efficacy and use of technology, identifying challenges of technology acceptance in older adults (Laver et al. 2011; Koopman-Boyden and Reid, 2009; Morris, Goodman & Brading, 2007; Melenhorst, Rogers & Bouwhuis, 2006). Henceforth, the successful design of learning units about smart home technology, especially online, may consider the recommendations to enhance one's self-efficacy, such as mastery, modelling and encouragement (Bandura, 1997) to name a few. Vroman, Arthanat & Lysack (2015) concluded that the most practical approach will be, first, the identification of functions and features of smart home devices that suit the individual needs of older adults, followed by learning about the benefits of relevant technologies.

(2) & (3) The preferred learning delivery mode varies across the national contexts, from blended to face-to-face/in group. Designing learning experiences for older adults about the utilisation of smart home technologies requires awareness that older adults are more familiar with analogue learning, such as via books, where the learner consumes the information provided and neither change the content nor is responsible for organising the information (Castilla, Botella, Miralles, Bretón-López, Dragomir-Davis, Zaragoza et al., 2018). Mooij et al. (2014) study revealed, that "psychological differences among learners seem to be more relevant than differences among European educational conditions, cultures or countries" (p. 525). This confirms Boulton-Lewis (2010) position that older adults' preferences are subjective, which in turn suggests that courses for older adults must combine different delivery methods with analogue and digital learning elements. Ross (2010) explored the perspectives of older adults about online learning and concluded that they are open for it. Nevertheless, it must be interactive and meaningful to them, as for older adults the main drawbacks of online courses happen when

these are too intensive, the online platform is too complex, and there is no personal interaction (Ross, 2010). Pincas (2007) added that older adults require: educators who are mindful of one's learning conditions, personalised support, and a space for self-fulfilment. Similarly, Chiu, Tasi, Yang & Guo (2019) conducted a multiple case study about the teaching strategies of experienced instructors at senior learning centres in Taiwan. The instructors combined various teaching strategies for older learners, such as reversed teaching, unscripted performance, and assistance from peers. Older adults require a flexible, self-regulated yet interactive approach, where learners can revise content and have a space to ask questions, preferably to peers, in a setting that allows them to complete the learning sequences at their own pace.

(4) The five case studies show that overall older adults have access to the internet but different levels of digital skills. Most older adults in this study must still advance their digital skills before engaging with smart home technologies. The lack of trust, emphasised by participants across all the five countries, is important to consider when designing learning experience for older adults about smart home technologies. Despite constantly more emerging IoT devices, this study confirmed that ICT tend to be not very popular among older adults (Pachis and Zonneveld, 2019; Schreurs, Quan-Haase and Martin 2017). According to Castilla et al. (2018, p.25), all causes of digital exclusion are related to "the lack of the fundamental requirements", such as: hardware access and mastery of technology. Schreurs et al. (2017) point out that poor digital literacy levels and lack of availability of support are the main barriers to a greater engagement of older adults with technology. The utilisation of smart home technologies requires that users perceive the benefits and accept the potential risks (Wilson et al., 2017).

6. Conclusion

Lack of familiarity with, and little or no previous knowledge of, smart home technology do not appear as barriers for future engagement of older adults with these innovations. However, this study confirms that the lack of experience and knowledge of ICT and low self-efficacy in its use hinders the relationship between smart home technology and older adults (Czaja & Lee. 2007; Hernández-Encuentra et al. 2009; Schreurs et al. 2017). They therefore require tailored learning experiences that address their needs and provide a space to gain experience and to experiment with technology. Learners need constant personal support to emerging questions, as well as having discussions on the benefits and challenges of these technologies. Designing a smart home technology course for older adults is timely as it helps fostering digital inclusion in an every-day older Europe. As to future research, one could illuminate the perspectives of older adults on learning about smart home technology in light of the consequences brought by the coronavirus crisis, such as issues surrounding health and social distancing.

References

Ali, B., & Awad, A. I. (2018). Cyber and physical security vulnerability assessment for IoT-based smart homes. *Sensors (Switzerland)*, *18*(3), 1–18.

Balta-Ozkan, N., Davidson, R., Bicket, M., & Whitmarsh, L. (2013). Social barriers to the adoption of smart homes. *Energy Policy*, *63*, 363–374.

Bandura A. (1997). *Self-Efficacy: the exercise of control.* W.H. Freeman and Company: New York.

Blatter, J. (2008). Case studies. In Given, L. (Ed.), *The Sage encyclopaedia of qualitative research methods* (pp.68–71). London: Sage.

Boulton-Lewis, G. M. (2010). Education and learning for the elderly: why, how, what. *Educational Gerontology*, *36*(3), 213–228.

Castilla, D., Botella, C., Miralles, I., Bretón-López, J., Dragomir-Davis, A. M., Zaragoza, I., & Garcia-Palacios, A. (2018). Teaching digital literacy skills to the elderly using a social network with linear navigation: A case study in a rural area. *International Journal of Human Computer Studies*, *118*(May), 24–37.

Central Intelligence Agency (2020). Germany. In The world factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html Accessed 4 June 2020

Central Intelligence Agency (2020). Ireland. In The world factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/ei.html Accessed 4 June 2020

Central Intelligence Agency (2020). Italy. In The world factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/it.html Accessed 4 June 2020

Central Intelligence Agency (2020). Romania. In The world factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/ro.html Accessed 4 June 2020

Central Intelligence Agency (2020). Spain. In The world factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/sp.html Accessed 4 June 2020

Chaffin, A. J., & Harlow, S. D. (2005). Cognitive learning applied to older adult learners and technology. *Educational Gerontology*, *31*(4), 301–329.

Chan, M., Esteve, D., Escriba, C., Campo, E., (2008). A review of smart homes—present state and future challenges. *Computer Methods and Programs in Biomedicine*, *91*(1), 55–81.

Chan, M., Campo, E., Estève, D., & Fourniols, J. Y. (2009). Smart homes - current features and future perspectives. *Maturitas*, *64*(2), 90–97.

Chiu, C. J., Tasi, W. C., Yang, W. L., & Guo, J. L. (2019). How to help older adults learn new technology? Results from a multiple case research interviewing the internet technology instructors at the senior learning center. *Computers and Education*, *129*, 61–70.

Czaja, S.J., & Lee, C.C. (2007). Information technology and older adults. In J.A. Jacko & A. Sears (Eds.), *The human-computer interaction handbook* (2nd ed., pp. 777–792). New York: Erlbaum.

Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: theory and results. Doctoral Dissertation, MIT Sloan School of Management.

Davis, F. D. (1989). IT usefulness and ease of use. *Technology*, (September), 319–340.

Davis F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*, 475–487.

Dogruel, L., Joeckel, S., & Bowman, N. D. (2015). The use and acceptance of new media entertainment technology by elderly users: development of an expanded technology acceptance model. *Behaviour and Information Technology*, *34*(11), 1052–1063.

EC (2015). Communication from the Commission C(2015) 6317 final. Towards an integrated strategic energy technology (SET) plan: accelerating the European energy system transformation. European Commission, Brussels, Belgium, (EC). https://ec.europa.eu/energy/sites/ener/files/publication/Complete-A4-setplan.pdf Accessed 12 June 2020

Eurostat (2020). Individuals level of digital skills. https://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database Accessed 8 July 2020

Flick, U. (2002). *An introduction to qualitative research*. (2nd ed). London: Sage.

Flores-Martin, D., Pérez-Vereda, A., Berrocal, J., Canal, C., & Murillo, J. M. (2019). Interconnecting IoT devices to improve the QoL of elderly people. *Communications in Computer and Information Science*, *1016*, 83–93.

Friemel, T.N. (2016). The digital divide has grown old: determinants of a digital divide among seniors. *New Media & Society*. *18*(2), 313–331.

Fuchs, C. (2015). *Culture and economy in the age of social media*. London: Routledge.

González-Oñate, C., Fanjul-Peyró, C., & Cabezuelo-Lorenzo, F. (2015). Use, consumption and knowledge of new technologies by elderly people in France, United Kingdom and Spain. *Comunicar*, *23*(45), 19–28.

Hartley, J. (2004). Case study research. In Cassell, C. & Symon, G. (Eds.), *Essential guide to qualitative methods in organizational research* (pp. 323–333). London: Sage.

Hernández-Encuentra, E., Pousada, M., & Gómez-Zúniga, B. (2009). ICT and older people: beyond usability. *Educational Gerontology*, *35*(3), 226–245.

Kamberelis, G. & Dimitriadis, G. (2005). Focus groups: strategic articulations of pedagogy, politics and inquiry. In Denzin, N. & Lincoln, Y. (Eds.). *The Sage handbook of qualitative research* (pp.887–907). Thousand Oaks: Sage.

Kania-Lundholm, M., & Torres, S. (2018). Ideology, power and inclusion: using the critical perspective to study how older ICT users make sense of digitisation. *Media, Culture and Society*, *40*(8), 1167–1185.

Kelly, D., McLoone, S., & Dishongh, T. (2009). Enabling affordable and efficiently deployed location based smart home systems. *Technology and Health Care*. 17, 221–235

Koopman-Boyden, P., and Reid, S. (2009). Internet/email usage and well-being among 65–84 year olds in New Zealand: policy implications. *Educational Gerontology*, *35*(11), 990–1007.

Laver, K., George, S., Ratcliffe, J., & Crotty, M. (2011). Measuring technology self efficacy: reliability and construct validity of a modified computer self efficacy scale in a clinical rehabilitation setting. *Disability and Rehabilitation*, *34*(3), 220–227.

Mabry, L. (2008). Case study in social research. In Alasuutari, P., Bickman, L. & Brannen, J. (Eds.), *The Sage handbook of social research methods* (pp. 214–227). London: Sage.

Melenhorst, A. S., Rogers, W.A. and Bouwhuis, D. G. (2006). Older adults' motivated choice for technological innovation: evidence for benefit-driven selectivity. *Psychology and Aging*, *21*(1),190–195.

Mooij, T., Steffens, K., & Andrade, M. S. (2014). Self-regulated and technology-enhanced learning: a European perspective. *European Educational Research Journal*, *13*(5), 519–528.

Morris A, Goodman J, Brading H. (2007). Internet use and non-use: views of older people. *Universal Access in the Information Society*, *6*(1), 43–57.

Pachis, J. A., & Zonneveld, K. L. M. (2019). Comparison of prompting procedures to teach internet skills to older adults. *Journal of Applied Behavior Analysis*, *52*(1), 173–187.

Pincas, A. (2007). How do mature learners learn? *Quality in Ageing*, *8*(4), 28–32.

Ross, A.K. (2010). *The perspectives of older adults regarding online learning*, California State University, Long Beach.

Schreurs, K., Quan-Haase, A., & Martin, K. (2017). Problematizing the digital literacy paradox in the context of older adults' ICT use: aging, media discourse, and self-determination. *Canadian Journal of Communication*, *42*(2), 359–377.

Sovacool, B. K., & Furszyfer Del Rio, D. D. (2020). Smart home technologies in Europe: a critical review of concepts, benefits, risks and policies. *Renewable and Sustainable Energy Reviews*, *120*(May 2019), 1–20.

Stake, R. (2005). Qualitative case studies. In Denzin, N. & Lincoln, Y. (Eds.). *The Sage handbook of qualitative research* (pp.443–466). Thousand Oaks: Sage.

Tse, M. M. Y., Choi, K. C. Y., & Leung, R. S. W. (2008). E-Health for older people: the use of technology in health Promotion. *CyberPsychology & Behaviour*, *11*(4), 475–479.

Twice (2019). Are consumers ready for connected home? All signs point to … almost. https://www.twice.com/retailing/twice-ces-2019-retail-roundtable-connected-home-almost-ready Accessed 22 June 2020

UN (2017). United Nations world population ageing 2017 highlights. https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf Accessed 5 May 2020

Vroman, K.G., Arthanat, S., Lysack, C., (2015). "Who over 65 is online?" Older adults' dispositions toward information communication technology. *Computers in Human Behavior*, *43*, 156–166.

Waters, J. (2015). Snowball sampling: a cautionary tale involving a study of older drug users. *International Journal of Social Research Methodology*. *18*(4), 367-–380.

WHO (2018). World Health Organization. Ageing and health. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health Accessed 5 May 2020

Wilson, C., Hargreaves, T., & Hauxwell-Baldwin, R. (2015). Smart homes and their users: a systematic analysis and key challenges. *Personal and Ubiquitous Computing*, *19*(2), 463–476.

Wilson, C., Hargreaves, T., & Hauxwell-Baldwin, R. (2017). Benefits and risks of smart home technologies. *Energy Policy*, *103*(January), 72–83.

Wolcott, H. (1994). *Transforming qualitative data: description, analysis, and interpretation*. London: Sage.

Yin, R. K. (2018). *Case study research and application: design and methods.* (6th Edition). Thousand Oaks: Sage.

