
Euan M. S. Frew

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An Examination of Physical Literacy:

by

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DEDICATION

As in any undertaking such as this, there are so many people that offer encouragement along the way, large or small, it ALL matters, so thank you! There are those however that are there with you throughout it all, and to them I want to offer this special dedication to thank them. My wife Eline, my son Aeden and my parents Euan and Anne; it is because of your belief, encouragement and love that I have managed to become a dad, work full-time, coach, renovate a house, deal with hardships and be present for special moments, all the while, dedicating myself to this study. Thank you for everything that you have selflessly done for me, I am ever so grateful.
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ABSTRACT

Technology integrated, flipped classroom design offers opportunities to engage students on various levels and through meaningful ways. Introducing this learning environment to students at an early age is likely to change their motivation for learning towards physical literacy and influence their lifelong participation in physical activity. The purpose of this action research was to evaluate the implementation of a new technology integrated, Flipped Classroom in a physical education class, to increase eighth-grade students’ physical literacy at an international middle school. The following research questions guided this study: (a) How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy?, (b) How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills?, and (c) What are eighth-grade students’ perceptions of how a technology blended physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?

There were 31 eighth-grade students from a variety of ethnic and cultural backgrounds, at an international middle school in the Netherlands participating in this action research. In order to address the research questions, both quantitative and qualitative data were collected, including (a) pre- and post-intervention questionnaires,
(b) student journals, (c) student interviews, and (d) student observations. Open-ended data from student observations, student interviews, and student journals were analyzed using inductive analysis. The student survey data was analyzed quantitatively, with inferential statistics, a paired samples t-test and descriptive statistics. The paired samples t-test findings demonstrated that there were no significant changes observed during the six-week intervention period to participants’ motivation and physical literacy scores. Contrary to this, the qualitative findings of the flipped classroom design revealed that the engagement and motivation to learn about physical literacy increased as a result of the intervention. Limitations to the study were presented in the quantitative findings in regards to the amount of time between the pre- and post- intervention questionnaires.
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CHAPTER 1
INTRODUCTION

There are currently 4,943 International Baccalaureate (IB) schools worldwide, and 18 of which are located in the Netherlands and offer the full IB Diploma Program (DP) ("Benefits of the IB", 2019). As middle schools prepare students to enter into the IB program, it is vital that they introduce students to the skills needed for twenty-first century learning. In order to form the fundamentals for success in relation to the IB DP rigors, an emphasis on foundational cross-curricular collaboration is necessary for preparation to enter into this program (Lesseig et al., 2016). The IB program is based on understanding the broader context of, deeper meaning, essential questions that relate to a multi-faceted learning approach. The need for cross-curricular learning, and collaboration are paramount in addressing a holistic approach to learning ("Benefits of the IB", 2019).

Despite taking a holistic approach, IB learning is focused around six specific subject area domains. These domains include studies in (1) language literature, (2) language acquisition, (3) individuals and societies, (4) sciences, (5) mathematics, and (6) the arts ("Benefits of the IB", 2019). Under the banner of “Sciences” is sport, exercise, and health sciences. This subject, within the science domain, is the only opportunity that IB students have to maintain some level of physical activity (PA) during the two-year duration of the diploma program. According to Tremblay (2016), the minimum
requirements for daily PA are 60 minutes of moderate-to-vigorous PA per day for youths and 150 minutes per week for adults. This would lead one to believe that, the holistic curriculum of the IB diploma falls short of living up to its own credo, and by leaving PA as an elective rather than a core component of the IB program, the importance of one’s physical health and wellbeing is left to the wayside. This in-turn negatively impacts the understanding students have of the importance of PA and physical literacy (PL). The younger that students are able to form habits and understanding of PL, the more likely they are to engage in a lifelong pursuit of PA (Basoglu, 2018; Nielsen, 2018; Zimmerle, 2019). Therefore, it is critical to implement a curriculum that addresses these needs, and do so in a meaningful way that engages all students while encompassing the pillars of PL.

The idea of PL has been shifting from early iterations when physical education (PE) as a subject was focused on skill acquisition, to where it is today, a subject that focuses on understanding the value, importance, and rationale behind being physically active (Mandigo et al., 2009; Sport for Life, 2020; Tremblay & Llyod, 2010). Translating this to lifelong PA.

The IB program model does offer a gateway into this process as part of their tenants, utilizing cross-curricular initiatives. Where cross-curricular learning offers opportunities to engage students on various levels and through meaningful ways. Creating such an environment at an earlier age offers the opportunity to change learners’ levels of PL (Costantino, 2018; Li et al., 2019; Payton et al., 2017). This is because it is likely to change their motivation towards this phenomenon and influence their lifelong participation in PA.
In 1998-9, the International Olympic Committee (IOC) funded a global study that investigated the state of PE in schools (Marshall & Harman, 2016). The study concluded that PE is on the decline in many respects, curriculum time, budgetary constraints and more. Because of this, students are missing out on the fundamental value of being physically active and therefore building their understanding of PL. What the implications of this are, is an increase in childhood obesity, lowered levels of physical wellbeing which lead to an increase in diseases such as type two Diabetes, higher levels of anxiety and depression, and the list goes on (Physical Activity Guidelines Advisory Committee, 2008). This is indicative of a poor understanding, based on antiquated PE practices, that are simply not relevant in today’s common understanding of what the subject domain is truly about (Basoglu, 2018; Domazet et al., 2016; Sum et al., 2016; Tremblay & Llyod, 2010; Tremblay et al., 2018).

As incredible as this phenomenon is, it has resulted in far less attention being given to our physical wellbeing, and as a result, is becoming a defining issue of our time. This shift to a more sedentary lifestyle is proving to have detrimental short- and long-term effects to our younger generations’ overall health (Li et al., 2019; Lynch, 2016; Saunders & Vallance, 2017; Whitehead, 2001). According to the *PA Guidelines Advisory Committee* report (2008), when students take part in at least 60 minutes of PA a day, multiple health benefits will result. These benefits range from better sleeping, lowered stress levels, higher levels of concentration, improved cardiovascular fitness to mention a few (Erwin, 2017; Kuczala & Lengel, 2017; Saunders & Vallance, 2017; Zhao & Li, 2018). Beyond the multiple health benefits, PA has demonstrated time and time again, increased academic performance as well as other cognitive benefits. This connection
illustrates just how important PA and PL are to have in our educational curriculums in order to influence and benefit the overall wellbeing of all students as lifelong participants of active living.

Every level of education is able to benefit from the benefits of PA, however, there are critical ages in which individuals generally develop and build the foundation of lifelong habits (McNeely & Blanchard, 2009). In order to change this perception and the decrease in PA within the school curriculum, it is critical that PE educators take the initiative and do so in a meaningful way. One such way to approach this is through a flipped classroom model (FCM) design. Incorporating this type of model into the PE curriculum offers the opportunity to demonstrate the value of PE and how it can serve as a vehicle for growth and understanding, especially utilizing a cross-curricular design (Corbin, 2016; Edwards et al., 2018; Lynch, 2016; Tremblay et al., 2018; Whitehead, 2001).

Targeting middle school learners, a critical age for this process, through a thoughtfully designed technology integrated, FCM, cross-curricular curriculum, is a necessity to engage students through discovery, interest and understanding (Payton et al., 2017; Thuneberg et al., 2019). As Bergman and Sams (2012) illustrate in their FCM construct, students find the FCM design in learning beneficial, as it affects their motivation towards learning in positive ways. FCM initiatives, when effectively utilized, are incredibly effective at engaging students, increasing their motivation and understanding of a theme or topic (Bergman, & Sams, 2012; Jaakkola et al., 2008; Sánchez-Oliva et al., 2017; Sun et al., 2017; Ulstad et al., 2019; Van den Berghe et al., 2012). More time spent on a deeper, more meaningful technology integrated, cross-
curricular FCM curriculum, will enable PE practitioners to create consequential learning opportunities to better understand PA, which in the vast majority of cases simply does not exist currently (Tremblay & Llyod, 2010; Tremblay et al., 2018). This will in-turn, enhance students’ understanding of PL and help live healthy active lives.

Taking this a step further, one such cross-curricular model gaining momentum is the STEAM (Science, Technology, Engineering, Art, Mathematics) framework. STEAM is possible next iteration of STEM (Science, Technology, Engineering and Mathematics), and an educational framework that generally utilizes a cross-curricular approach for transdisciplinary, project-based learning (PBL). STEAM provides a framework that can easily be integrated into specific PE curriculum units, and can address this notion of deeper understanding into learning from a PE centered perspective and more specifically towards PL (Erwin, 2017; Tremblay & Llyod, 2010; Tremblay et al., 2018). This allows students to explore and learn about the world around them (Herro & Quigley, 2017; Quigley et al., 2017; Radziwill et al., 2015; Rahmawati et al., 2019; Rolling, 2016; Sheffield, 2017; Thuneberg et al., 2019). Within this process, produce a meaningful artifact that showcases what they have learned.

Developments in technology are evolving faster in the last few decades than they have at any other point in history (Payton et al., 2017). Having a thoughtful, holistic framework to address the needs of PE students in a PBL environment is critical to address the needs of tomorrow’s emerging and growing fields, while ensuring that learners understand the value of PA (Radziwill et al., 2015; Rahmawati et al., 2019). There is no doubt that finding the balance here is critical as, according to Nielsen (2018) and Zimmerle (2019), the growing dependence on technology has resulted in
unprecedented amounts of screen time in our youths with up to nine hours a day spent in front of some sort of screen, which is leading us into certain dilemmas. How can we change screen time to benefit learners, while offering a better conceptual understanding of PL in the process?

This is where the Flipped Classroom Model (FCM) offers a dynamic opportunity for learning. By taking that screen time and creating content for students to interact with before class, instructors are able to better develop curriculum that engages learners in a time effective manner (Clark, 2015; Sargent & Casey, 2020; Smith, 2015). Instructors are better able to meet the needs of their students with the FCM, thus resulting in higher efficacy within their learning environments (Hunley, 2016; Isaias et al., 2017; Peterson, 2016). FCM combined with a cross-curricular, transdisciplinary learning initiative, such as STEAM, can have a profound impact on learning and attaining specific learning objectives.

Despite STEAM being introduced, and practiced as an effective learning methodology since 2007 (Thuneberg et al., 2019), there is apprehension about the efficacy of the framework and its integration into and within the unit. This is mainly due to the investment needed for developing such a transdisciplinary unit, as a teacher-lead initiative (Costantino, 2018; Li et al., 2019; Payton et al., 2017). Similarly, FCM is an intensive endeavor for teachers with a considerable amount of upfront planning that can be seen as quite daunting (Baker & Hill, 2017; Bergmann & Sams, 2012; Enfield, 2013). That being said, a transdisciplinary framework overlayed with an FCM is a substantiated learning design (Ferriz-Valero et al., 2022; Li et al., 2019; Payton et al., 2017; Perignat & Katz-Buonincontro, 2019; Thuneberg et al., 2019). This is a learning design that engages
students with higher-level thinking tasks and challenges (McLean et al., 2016; Mortensen & Nicholson, 2015; Saulnier, 2015). Despite this, educators in many cases, are lacking the professional support structures needed to investigate and develop cross-curricular FCM opportunities, within their context, that aim to enhance student learning (Al Salami et al., 2017; Avramides et al., 2015; Thuneberg et al., 2019). This problem is exacerbated in an international middle school setting, where it is commonly known that schools decide which, if any, guiding curriculums to follow. Developing a framework to support and engage student learning is the desired outcome in researching the benefits of an FCM design initiative. The STEAM framework, integrated into specific PE curriculum units using a technology-based FCM, acts as such a supportive framework (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). Implementing and observing an FCM helps to determine the efficacy that the STEAM framework’s overall impact is on middle school students’ motivation towards building their PL. The evidence suggests that it is critical to keep in mind, the importance of the physical development of our learners (Corbin, 2016; Edwards et al., 2018; Erwin, 2017; Mandigo et al., 2009; Physical Literacy, 2020; Saunders & Vallance, 2017; Tremblay & Llyod, 2010; Tremblay et al., 2018; Zhao & Li, 2018). This is the case as PL contributes to the overall cognitive growth and wellbeing of the learner.

In order to develop student motivation towards increasing PL knowledge, it is essential to select the best tools for this endeavor. As Mishra and Koehler (2006) demonstrate in their technological, Pedagogical and content knowledge model (TPACK), the technology selected is meant to complement the curriculum and pedagogical processes that were employed in this intervention. Understanding and translating the
effects of an FCM design, integrated into a PE curriculum unit, outlining student engagement and motivation towards PL, was the focus of this study. The integration of technology determined the learning possibilities that arose from this endeavor, as Sargent and Casey (2020) indicated, there was little research in this area.

This gap in the research, for this particular area, has little in the way of data focused on the topic specific to international middle schools. For this reason, having created an FCM using a case study design that examined the efficacy of transdisciplinary curriculum to measure student motivation towards learning about PL within an international middle school setting, was untested. Despite being unverified, the concomitant and analogous evidence, tended to indicate that students would benefit from this proposed initiative (McLean et al, 2016; Mortensen & Nicholson, 2015; Saulnier, 2015). Learners would also likely see increased levels of engagement and motivation in learning PL (DeCoito & Myszkal, 2018; Erwin, 2017; Lesseig et al., 2016; Mandigo et al., 2009; Payton et al., 2017; Physical Literacy, 2020; Saunders & Vallance, 2017; Thuneberg et al., 2019; Tremblay & Llyod, 2010; Tremblay et al., 2018). The current literature demonstrates that this initiative is a worthwhile endeavor to determine the efficacy of the intervention.

**Local Context**

The study focused on eighth-grade students at an international middle school in the Netherlands. As the research took place in an international school, it was important to factor in that the population within this school was quite culturally and ethnically diverse. It should also be noted that the school had a fairly transient population (American School of The Hague, 2019). As noted by Hardman (2008), the trend of European schools has
been to decrease the amount of curriculum time spent on PE, much to the detriment of students. This same decline is also visible throughout international schools (Erickson et al., 2012). As the school, subject to this intervention, was both a European and an international school, it was by no means an exception to this phenomenon. The amount of PA curriculum time found within one week of a two-week rotational schedule, illustrates this issue with a noticeable percentage of students participating in as little as 75 minutes in one of the two-week rotations. This is far below the recommended 60 minutes per day of PA (Physical Activity Guidelines Advisory Committee, 2008). What this clearly displayed was a problem leading to difficulties and challenges in encouraging students to be more physically active and engaged more in PA. In examining the past six years of student data collected from ASH students, using the Cooper Institute’s FITNESSGRAM standardized testing model as a tested and valid instrument (Morrow et al., 2010), it was clear that overall, the trends of physical fitness have decreased in some cases and in many others are stagnating. This was indicative of a worldwide trend according to Marshall and Hardman (2016), where there was an ever-growing problem of obesity within our youth. Given that it was unlikely to be able to carve out more curriculum time for PE at ASH, offering students an alternative to in-class synchronous learning had the potential to be a viable and sustainable option. Students were expected to engage a large portion of their school work online; therefore, it stands to reason that there was an opportunity to enhance learning through this means. Understanding how that would function in a PE context had not yet been fully explored. Using technology as a way to compensate for a lack of in-class curriculum time could offered several benefits to enhancing PL. With increased levels of engagement, the anticipated result was an increase in PL. In order to fully
maximize engagement, cross-curricular learning is another tool that was underutilized and given the research (Jaakkola et al., 2008; Sánchez-Oliva et al., 2017; Sun et al., 2017; Ulstad et al., 2019; Van den Berghe et al., 2012) had incredible potential to facilitate an even greater result when combined with this technology-based initiative. Selecting the appropriate method is critical in order to find full efficacy of changing motivation towards learning PL.

In order to enhance student motivation of learning towards PL, cross-curricular, more specifically, transdisciplinary approaches were essential components in ensuring the efficacy of this intervention (Avramides et al., 2015; Herro & Quigley, 2017; Herro et al., 2019; Quigley et al., 2017). This deeper understanding of concepts and essential questions created a need for solutions and looking outside of the traditional PE pedagogical models, in order to ensure the acquisition of necessary skills vital to a twenty-first century learner can be applied (Avramides et al., 2015; Costantino, 2018; Ghanbari, 2015). In examining course content and learning outcomes, the indications were evident that there was a need to provide support for increased cross-curricular collaboration opportunities (Herro & Quigley, 2017). There was also a push towards better utilization of technology-based learning platforms. This was in order to create a more meaningful way in which engaged students and interacted with curricula that motivated them to learn (Herro & Quigley, 2016; Lee & Williams, 2015). Understanding how to most effectively use these platforms provided (Google Apps, Power Teacher Pro, Power School Learning and Rubicon Atlas) was essential in building PE curriculum units. Overlaying this with a STEAM framework was likely to change students’ motivation for learning towards PL.
As a core class teacher in an international middle school setting, I conducted an informal survey amongst my colleagues that found on average, only 10 percent of units taught in a year-long core course (Math, Science, Social Studies, PE and Language Arts), by grades five, six, seven and eight teachers, were done so in a cross-curricular manner. None of which were done so using a transdisciplinary, or FCM method. This number was indicative of an underutilization of a valuable learning paradigm to engage and motivate student learning, while enhancing the experience of our middle school students (Avramides et al., 2015; DeCoito & Myszkal, 2018; Herro & Quigley, 2017; Herro et al., 2019; Lesseig et al., 2016; Payton et al., 2017; Quigley et al., 2017; Thuneberg et al., 2019).

Beginning back in the 2018-2019 school year, there has been a middle school-wide initiative for increasing teachers’ level of cross-curricular collaboration between subjects, which lent itself to the opportunity to implement a transdisciplinary framework, such as STEAM, into specific PE curriculum units that were designed to deepen all grade eight students’ PL within the school. Due to this, the data collected from this study was representative of the potential outcomes that an FCM, technology integrated, transdisciplinary framework, integrated into specific PE curriculum units had on the motivation for learning PL for students.

**Statement of the Problem**

Students were not getting the time they needed within the curriculum to satisfy their daily recommended needs for PA (King, et al., 2019; Physical Activity Guidelines Advisory Committee, 2008). As a result of this, students were generally not achieving the amounts of recommended PA outside of school either. This was resulting in the
frightening prospect where current trends are putting our society in risk of serious health issues in the future. This trend of inactivity has for the first time, created a clear and present danger that is very likely to result in an overburdening of our healthcare systems (Barnes, et al., 2013; Marshall & Hardman, 2016). Less time engaged in school-initiated PA and PE classes will result in a depreciation in the values associated with being physically active. This phenomenon was likely to result in a decline with general understanding of what PL was. Motivating students to learn PL was imperative to ensure that we were educating our students about the benefits of long term healthy, active living.

Engaging students in learning means finding relatable and exciting ways to do this. Finding impactful ways to do this requires an understanding of pedagogical practices that aim to motivate learners in a thoughtful and meaningful way. To determine where a shift should occur, a careful examination in pedagogical practices needed to happen. As such, a pedagogical approach that has been underutilized at ASH, yet has demonstrated its learning value, in all levels of education, was an FCM, cross-curricular learning and more specifically, a transdisciplinary learning framework such as STEAM (Al Salami et al., 2017; Herro, & Quigley, 2017; Herro et al., 2017; Liao, 2016). Students could not only build their subject knowledge, they could deepen their understanding of it as they applied previously learned concepts and skills to new real-world problems (Quigley et al., 2017). The benefit from a transdisciplinary curriculum that addressed a variety of subject domains demonstrated itself to motivate learners towards the specific task outcomes.

As of this study, ASH, an international school in the Netherlands, pedagogical design was seldom practiced and as a result, there were missed opportunities to create meaningful learning for students. There needed to be a concerted effort to actualize this
and bring it into common practice. As such, PE may seem an unlikely place to begin this endeavor, however, seeing as the current problem at hand is that eighth-grade students were not demonstrating desired levels of PL knowledge, the implementation of a cross-curricular, technology integrated PE curriculum, based on the STEAM framework, might increase students’ PL knowledge.

**Purpose Statement**

The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit to increase eighth-grade students’ PL knowledge and motivation at an international middle school.

**Research Questions**

The research questions that guided this study were:

**RQ 1**: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy?

**RQ 2**: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills?

**RQ 3**: What are eighth-grade students’ perceptions of how a technology blended physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?

**Statement of Research Positionality**

When reflecting on my own positionality with regards to my research, there were several facets to what was likely to shape my perceptions and strategies towards this
research intervention as well as methods that I implored to conduct it. As a white, middle-aged male from a developed western democratic nation, there were inherent views that over the course of my life have become ingrained in me. This likely formed certain perspectives that aligned differently to those participants from cultures that potentially place different emphasis on behaviors and values than are diverse from mine.

Having lived overseas for the past two decades, I am cognizant of the fact that there are many ways to do the same thing, and patience is a principal element in understanding. As a life-long athlete, an instructor of health and sports, as well as an experienced coach, it is fair to say that I have some biases towards being physically active. I have a high level of PL and the nature of my motivation to engage in PA comes completely from an intrinsic love of sport, competition and PA. That being said, as I evolve as an educator, this is superseded by the desire to help everyone find an activity that they can be passionate about. This desire for everyone to be active sometimes results in losing sight of the fact that not everyone enjoys sport, or more to the point, not all participants within the context of the research, were coming from cultures where sport was viewed as important, or a part of daily life.

Looking back over my teaching career, the importance of my ideological inclinations and leanings has consistently met with many of those that fall under and align with the constructivism paradigm (Grant, 2016). As an international educator, I have had my horizons and worldviews opened to many differing education systems. Throughout this, my views are that there are multiple realities dependent on one’s own experiences and how they interpret these. Our previous experiences determine how we interpret this knowledge (Mertens, 2009). Although in many ways I relate to the
constructivist paradigm, I do not strictly adhere to a specific philosophical belief and for that reason, a pragmatic approach lends itself well to my area of study. This is to say that each individual experience is unique and therefore creates different interpretations of what could be viewed as the same reality (Mertens, 2009). These differing worldviews are based on how each of my experiences impacts my reality and likewise, those experiences of my students impact their realities (Creswell & Creswell, 2018).

Participants coming from cultures that do not view PA as having any particular real value, tend to differ greatly from my own upbringing. Throughout my life, I have been encouraged and supported with all of the physical activities that I have undertaken. This is because it is understood that being physically active is important to one’s wellbeing. I have played high level competitive sports. I hold certifications of higher-level coaching in more than a dozen sports. I participate in competitive team sports on a regular basis, and do a variety of other individual pursuits. It is safe to say that PA is one of my principal life tenants. Because of this, it may sometimes be challenging to relate to those who are not interested in sport, despite my best efforts and unflappability.

Furthermore, not having any physical ailments or impairments innately ensures that participants with such issues may not be able to form an attachment with my philosophy and views on PA. Psychological aspects of the dynamic may also be perceived incorrectly due to my age and experience level. Middle school students are in a critical stage of development both physically and mentally, and therefore, lack confidence and/or understanding of theoretical and existential concepts. This can lead to misunderstandings or misconstruing the intent of an activity, that in my experience seems to be straightforward and clear.
As the nature of my context was one that was fairly transient in nature, the participants in my intervention were, in many instances, coming from schools where the emphasis on sport did not exist, or that the pedagogical and philosophical outlook was very different. Despite my best efforts, these types of parameters create a challenge that was incredibly difficult to specifically prepare for, so to reiterate what has been stated earlier, patience was the principal element of understanding.

Keeping this in mind, this led to my positionality in the intervention. As an outsider, this situates me in regards to the student participants of my action research as a perceived authoritative figure over them. As this research’s main idea was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit to increase PL knowledge, perceived pressure to respond with a certain response did not be present as the study focus was on what was best for the participants and not set to a specific outcome. This hopefully demonstrated the beneficence of the study for the student participants.

In general, with my fundamental beliefs rooted in the constructivist paradigm, I viewed this research as an opportunity to grow and seek out ways to improve my pedagogical practice and understanding of educational technology as well as a deeper understanding of the Constructivist theory and Self-determination theory. As long as the objective remains, my values and biases did not have any significant impact on the efficacy of the research.
Definition of Terms

**STEAM:** As a widely used term, STEAM (Science, Technology, Engineering, Arts and Mathematics) is generally defined as a cross-curricular education model between the Arts and Sciences designed to develop analytical and creative thinking skills within a 21st century environment, as well as ensuring students’ opportunities for success in a rapidly changing world (Land, 2013; Teneglia, 2017; Townes, 2016).

**Motivation:** For the purposes of this intervention, motivation was defined from the Self-determination theory perspective, with three core tenants being the principal makeup of this term: *Competence, autonomy* and *relatedness* (Deci & Ryan, 2000). These three tenants compose the innate psychological need for learners to positively engage in an activity, specifically with relevance to physical pursuits (Bryan & Solomon, 2007).

**Student engagement:** This is generally defined as the behavior on the part of students that is positively related to grades, satisfaction and critical thinking outcomes (Axelson & Flick, 2011; Flynn, 2014; Zilvinskis, et al., 2017).

**Fitness and conditioning:** This is termed as units generally defined by their focus on cardiovascular endurance, muscular strength and endurance, as well as flexibility. Exercises such as, but not limited to, core focused, stability, coordination exercises, speed drills and agility tests are utilized throughout to measure the impact of the fitness and conditioning units (Gao et al., 2008).

**Motivated Strategies for Learning Questionnaire (MSLQ):** This was defined as a measuring device with proven validity which will gauge the motivation of students through a pre and post intervention questionnaire (Pintrich et al., 1991).
**Physical literacy (PL) skills**: This is generally described as, having the physical and cognitive ability to understand the value of PA and take part in it as a lifelong practice (Basoglu, 2018; Giblin et al., 2014; Physical Literacy, 2020; Sum et al., 2016; Tremblay & Llyod, 2010; Tremblay et al., 2018; Whitehead, 2001).

**Flipped classroom model (FCM)**: This term defines the model in which this intervention’s curriculum design was guided by. This model is based upon flipping the traditional teacher-lead model in-class content delivery, to the content being delivered prior to class through media. When the students come to class, they applied their knowledge to the task at hand under the guidance of the instructor, offering them autonomy and optimized time for learning (Clark, 2015; Sargent & Casey, 2020; Smith, 2015).

**Transdisciplinary learning**: This is defined as, learning where the learner was able to decide which domain, or domains of learning in a school setting, best serve them in addressing and solving real-world problems or tasks (Quigley et al., 2017).
CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit to increase eighth-grade students’ PL knowledge and motivation at an international middle school. This literature review focused on the following research questions: (a) How and to what extent does a technology integrated, flipped classroom, PE unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about PL? (b) How and to what extent does a technology integrated, flipped classroom, PE unit, enhanced with the STEAM model, impact eighth-grade students’ PL skills? (c) What are eighth-grade students’ perceptions of how a technology blended PE curriculum, enhanced with the STEAM model, impacted their PL skills?

Strategies for Literature Searches

In order to conduct the research for this study, the University of South Carolina Libraries A-Z databases were appropriated. Within this collection of 442 databases, the search parameters were further narrowed to: 29 under the Education subject selection and 31 under the Psychology subject selection. Through deep research and investigation of these databases, a more refined selection was determined as beneficial to my particular line of study concerning (a) Flipped Classroom Model learning, (b) motivation (c) PL and practice, as well as (d) PE. Six databases
from *Education* were predominantly used, while one from the *Psychology* subject selection. These various databases were utilized in order to search out and find the vast majority of resources used for this study. The six databases from *Education* were: *Education source*, *ERIC (EBSCO)*, *Dissertation and theses global*, *Education source*, *Google scholar* and *International encyclopedia of education*. While the single database from *Psychology* was *Psychology and behavioral sciences collection*. The six *Education* databases aided in forming an understanding of the STEAM framework and learning; transdisciplinary and inter-disciplinary learning; project and problem-based learning and PL. The *Psychology* database helped identify various definitions of motivation, specifically, *Self-Determination theory* (SDT) and other effective tools and ways to measure motivation.

**Key words search.** Initially, the starting point was to utilize the databases, as mentioned from the previous section, to formulate a starting point. Searching through, and for various scholarship for my study, I began with broad sweeping terms, such as: *STEAM/STEM learning*, *cross-curricular learning*, *PE* and *problem-based learning*. The net result offered a broad scope of ideas and terms to further investigate. These terms included: *Transdisciplinary*, *PL*, *motivation theories*, *interdisciplinary* and *teacher/student efficacy*. After sifting through the scholarship, I turned my focus to searching for specific authors, such as: *Vygotsky, Pintrich, Deci, Herro, Quigley* and *Ghanbari*. When it came to the theoretical side of the research, the parameters that were searched only included English as the written language. As for the peer-reviewed journals, articles and book chapters, a series of constraints were set throughout the searches. These constraints consisted of references within the past ten years, in English,
peer-reviewed and full-text available. Fortunately, with these limitations, and the usage of several combinations of the aforementioned search terms, results came back with under 100 at the higher end, however, searches tended to generally reveal 15-20 results. The older references often came from mining from other, more recent articles and journals.

**Mining from other research.** Through researching the plethora of scholarship on the various topics within my study, it became clear that there were many additional sources available. Careful mining of article and journal reference sections with related studies, concepts and theories (STEAM and SDT), definition of terms (transdisciplinary or inter-disciplinary), intervention design (MSLQ) and other critical aspects of my study could be measured. Mining offered perspective and insight into leading authors in the field such as Whitehead, Tremblay, Herro, Deci, Quigley, Pintrich and others. This added to the depth of contemporary understanding in a relevant way, to approach the purpose of this study.

**Organization of the Literature Review**

The organization of the literature review is ordered according to the following four sections: (a) PL, focusing specifically on defining what it is, the significance and the leading PL research review. (b) Motivation about PE, focusing on a specific motivational model, the significance of it, review the research about strategies to improve motivation from the Self-Determination Theory (more specifically, the basic needs theory) perspective, and the integration of technology to support motivation. (c) Flipped classroom model, examining what a flipped classroom model is, the components that make up the FCM, the foundations of the FCM and an examination of the advantages and disadvantages of the FCM, (d) Transdisciplinary curriculum, offering a definition of the
term, utilizing a constructivist approach to learning, compare the terms trans- and inter-disciplinary curriculums, reinforce the importance of transdisciplinary curriculum, and further indicate the importance of transdisciplinary curriculum on PE education, problem-based learning as a means to connect learning. And (e) STEAM framework, identifying a definition for STEAM, postulating STEAM effects on PE, followed by a review of research on motivation, and following, a research review on PL. The proceeding is meant to offer a comprehensive examination and understanding of the FCM framework, its impact on PL and through the SDT lens, and the motivation for learning that students are engaged in.

Studies examining the integration of PE into a STEAM framework at the middle school level and moreover, at an international middle school, are somewhat limited. Therefore, research focused on integration of activities that fall under the category of The Arts are used as comparisons from various educational levels to support postulated findings. Studies that identify the value of cross-curricular endeavors are assessed as well. The examination of cross-curricular initiatives involving PE and other subjects such as literacy and numeracy are utilized as well as guiding references for this research.

**Physical Literacy**

It has become increasingly clear over the past two decades that the value of PL and PA within education has progressively grown in its perceived and understood importance (Basoglu, 2018; Domazet et al.,2016; Sum et al., 2016; Tremblay & Llyod, 2010; Tremblay et al., 2018). The term PL has come to signify the gateway to PA as it offers the theory and rationale behind being physically active. Increasingly, PE practitioners strive to propagate PL to their learners in order to effectively take with

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them, an understanding of the importance of a physically active lifestyle and a lifelong understanding of it (Mandigo et al., 2009; Sport for Life, 2020; Tremblay & Llyod, 2010). This section will comprise of (a) a definition of PL, (b) the significance of PL, and (c) perform a PL research review within the scope of this study.
Definition

PL is generally described as having the physical and cognitive ability to understand the value of PA and take part in it as a lifelong practice (Basoglu, 2018; Giblin et al., 2014; Physical Literacy, 2020; Sum et al., 2016; Tremblay & Llyod, 2010; Whitehead, 2001). There are four facets of PL that should be observed in practice: (a) affective, (b) physical, (c) cognitive, and (d) behavioral. These facets represent the learner as an entirety, addressing all aspects of the physical, emotional and mental wellbeing of the individual (Corbin, 2016; Edwards et al., 2018; Physical Literacy, 2020; Tremblay et al., 2018; Whitehead, 2001). As Whitehead (2001) outlines, affective is the area that refers to an individual’s motivation and confidence; their outlook on PA and desire to adopt a life-long love for sport. PL is the foundation that underpins a more meaningful understanding of PA (Sport for Life, 2020; Tremblay & Llyod, 2010; Whitehead, 2008).

While the physical is the aspect that refers to the gained physical abilities that the individual acquires with exposure and practice to various physical activities. This is then applied to other physical activities and settings. This transference is critical in building a meaningful understanding and growth to foster a deeper understanding of PL (Corbin, 2016; Sport for Life, 2020; Tremblay & Llyod, 2010; Whitehead, 2001; Whitehead, 2008).

The cognitive is where the individual gains an understanding of the benefits that come along with PA. Learning to appreciate these benefits indicates an existential understanding of PL. Having this cognitive understanding connects PA to following a life-long healthy lifestyle. This is also the case when set into various, relevant PA contexts and situations (Tremblay & Llyod, 2010; Whitehead, 2001; Whitehead, 2008).
Finally, the *behavioral*, this is where the individual chooses to seek out opportunities to be physically active as part of a life-long love of sport and activity. Understanding the impact that an active lifestyle will have on one’s wellbeing is the underpinning of this facet. The impact of this particular facet is, a healthier population that will see the benefits of longer healthier lives in the future (Sport for Life, 2020).

These four facets define PL and how pedagogically, educators are able to effectively design curriculum to ensure that PL is effectually taught. Through this understanding of what PL is and the four domains that make it up, provide efficacy of learning with PE standards and learning outcomes being achieved.

Recognition from all over the world of the importance of PL by in-service educators has led to the implementation of more thoughtfully designed curriculum encouraging the use of Whitehead’s (2001) four facets of PL (Corbin, 2016; Edwards et al., 2018; Physical Literacy, 2020; Tremblay et al., 2018; Whitehead, 2001; Whitehead, 2008). This is a critical step in developing a standardized vantage to ensure that the notion of PL is viewed as an important part of every learner’s education and promoted within PE.

Whitehead’s (2001) four facets act as a foundation for PE curriculum design and implementation. More PE educators are joining this movement, thus ensuring that there will be new generations of understanding to the importance of a healthy and active lifestyle. This more holistic approach to PA, promoting its understanding through the concept of PL, is important to evolve PE as a critically important school subject (Basoglu, 2018; Corbin, 2016; Edwards et al., 2018; Giblin et al., 2014; Physical
Literacy, 2020; Sum et al., 2016; Tremblay & Lloyd, 2010). A critical step in advancing the PL concept.

**Research Review on Physical Literacy**

Understanding the physical benefits of an active lifestyle are critical components in an individual’s overall physical wellbeing, however, with more research being devoted to cognitive development through PA, it is apparent that PA positively influences brain development (Li et al., 2019; Lynch, 2016; Whitehead, 2001). The development of cognitive growth amongst physically active individuals is higher than those with more sedentary lifestyles. Learners demonstrate 10-15% higher test scores by simply performing some moderate to vigorous PA prior to test taking (Erwin, 2017; Kuczala & Lengel, 2017; Saunders & Vallance, 2017; Zhao & Li, 2018). There is a paradigm shift occurring where current PE curriculum design and practices are moving away from traditional sports in the context of rules and skills acquisition (Kirk, 2013; Mikaelis, 2018). This shift is toward a focus on design and practice to understand the roles of movement and PA that are no longer limited to a specific sport construct.

PE is looking to engage learners in multiple venues and settings through various contexts to ensure that PL is differentiated and learned (Kirk, 2013; Li et al., 2019; Mikaelis, 2018), this ensures that the subject matter is highly adaptable for various settings and contexts (Lynch, 2016; Mikaelis, 2018). This is important, as it allows for the integration of PL into cross-curricular settings in a very effective and complimentary way. Recent studies have demonstrated the importance of a PL when it comes to effective PE curriculum design (Basoglu, 2018; Nielsen, 2018; Zimmerle, 2019). The importance of making PA a part of students’ lives in this day and age, where, according to Zhao and
Li (2018), students are finding themselves spending upwards of eight or nine hours of screen time daily, presents PL as an incredibly relevant topic and practice within PE. 

**Significance**

Understanding the physical, psychological, and emotional benefits of an active lifestyle are critical components in an individual’s overall physical wellbeing; however, with more research being devoted to cognitive development through PA, it is apparent that the direction of research is in the area of how PA positively influences brain development (Corbin, 2016; Li et al., 2019; Lynch, 2016; Whitehead, 2001). This direction of study and research has proven itself to illustrate just how important physical wellbeing is on development and growth.

The development of cognitive growth amongst physically active individuals is higher than those with more sedentary lifestyles. Learners demonstrate 10-15% higher test scores by simply performing some moderate activity prior to test taking (Erwin, 2017; Kuczala & Lengel, 2017; Saunders & Vallance, 2017; Zhao & Li, 2018).

**Review of Research to Improve Physical Literacy**

According to Tremblay and Lloyd (2010) identifying a common definition and language for educators to work from is the initial step to improving PL and its understanding. Ultimately, having a common language will ensure consistency and standardization of PL. This will inherently promote more informed and knowledgeable practices. The next step should be a standardized and comprehensive set of assessment standards in order to ensure a more meaningful curriculum. These assessment standards need to be more comprehensive in nature, while looking beyond simple skill acquisition...
In order to improve and raise the awareness of the importance of PA, it is critical to create a more comprehensive means of assessing students in order to raise the standard of PE universally and ensuring this is shared through districts, provinces/states and beyond. Sharing the scholarship is fundamental in determining the efficacy of PL (Tremblay & Lloyd, 2010; Tremblay et al., 2018).

There are many reasons as to why a models-based practice (MBP) PE program is how the curriculum should be delivered and offers two rationales for it: the examination of one established pedagogical model and PL. As Corbin (2016), Edwards et al. (2018) and Kirk (2013) indicate, what this means is that rather than following the traditional route where students are taught a specific sport and related skills to that sport, learners are taught concepts, such as invasion tactics, or cooperative learning, in order to focus on transferable life-long skills that go beyond the PE class activity and engage deeper meaning and understanding.

As is the case more often than not, all schools are not created as clones of one another and this is where an effective measure needs to be in place. Designing a place-responsive PE curriculum offers flexibility to educators to address and design lessons to meet the needs of their specific context, thus furthering the improvement of PL (Corbin, 2016; Edwards et al., 2018; Mikael, 2018). What this could look like is a community-based initiative that utilizes a PE theme, such as cooperative learning, as a means for outreach and fostering positive relationships.

Motivation About PE
In order to determine the motivation of students towards PA and PL, a method of measuring motivation needs to be effectively utilized. To do this, motivation in the context of PE needs to be situated through the lens of self-determination theory. As indicated in the previous section, PL is essential in determining an individual’s lifelong inclination towards PA and their overall wellbeing. In light of that, the pragmatic approach to determine how to encourage PL, we need to determine what motivates learners to engage in PA? By postulating this, we are able to research and gain further insight to aid with design and implementation. This section will (a) situate the motivational model, (b) discuss the significance, and (c) review the research about strategies to improve motivation from the SDT perspective.

**Motivational Model**

Self-determination theory (SDT) of motivation maintains that, “an understanding of human motivation requires a consideration of an innate psychological need for competence, autonomy, and relatedness” (Deci & Ryan, 2000, p. 227). SDT has particular relevance to PE and physical pursuits in that according to Bryan and Solomon (2007), “the behavioral regulation mechanism may influence the degree to which individuals are physically active.” (p. 262).

*Competence* is where the individual feels that they are able to effectively partake in an activity. The individual understands the activity or task and is able to follow along with the rigors and concept (Harter, 1978; Ulstad et al., 2019; White, 1963). *Autonomy* is where the learner feels that they are participating by their own accord and not forced to do so. There is a lack of external pressure or circumstance involved with activity participation (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). *Relatedness* is where the
learner feels acceptance by the group within the context of the activity setting, as well as a connection to the group that they are with (Baumeister & Leary, 1995; Reis, 1994; Ulstad, et al., 2019).

Through the framework of self-determination theory, the idea is that autonomous and controlled motivations are different from one another. Behaviors can be classified somewhere along this continuum of amotivation to intrinsic motivation; between extrinsically controlled to completely autonomous. SDT offers that both the experience and process are different from one another and shape the individual’s motivation (Cecchini et al., 2011; Deci & Ryan, 2000; Fathali & Okada, 2018; Gagné & Deci, 2005; Jaakkola et al., 2008; Jeno et al., 2019; MacIntyre et al., 2018; Nation-Grainger, 2017; Schuitema et al., 2016; Sun et al., 2017; Ulstad et al., 2019; Van den Berghe et al., 2012). As this research does not necessitate more in-depth analysis of the SDT, it should be noted that Ryan and Deci (2017) have put forth several sub-theories to further explain in more depth, aspects of SDT. One such theory is the basic needs theory. This theory contends that the higher the ability of the individual to meet the three basic needs, the more likely they are to find success in PA constructs (Bryan & Solomon, 2007). What this results in are higher levels of PL and participation.
Significance

To increase the likelihood of life-long participation in PA, designing curriculum to engage the learners through their life where they are autonomously motivated to take part in PA is fundamental. Within their time during learning and building their foundation of PL, intrinsically motivated individuals are far more likely to go on and maintain an active lifestyle. This is somewhat of a guiding principle behind gaining an understanding of PL. Having a broad and working understanding of the scope and sequence of SDT, ensures that educators are working towards this common goal or outcome where learners are likely to continue on with a physically active lifestyle (Sánchez-Oliva et al., 2017).

Review of Motivation Research from the Self-Determination Theory Perspective

In offering the learner more of self-determined forms of regulation, there is a correlation outcome with positive consequences, meaning that when there is choice the learner feels better about performing and taking part in the activity or task (Jaakkola et al., 2008). The SDT framework is increasingly utilized in PE as a means to measure and identify three types of behavioral regulations, otherwise known as: intrinsic motivation, extrinsic motivation, and amotivation (Cecchini Estrada et al., 2011). Motivation is a major factor in determining performance and learning outcomes for students in PE, as the learner is inherently likely to perform in tasks that they are more confident or suited to do (Bandura, 1978; Van den Berghe et al., 2012). Different profiles have been postulated, however, the “self-determined” profile was linked to high levels of effort, enjoyment and learning cooperatively, while maintaining a low level of boredom and unequal recognition (Sun et al., 2017). This situates the idea of motivation through SDT, as inherently up to the design of the lesson, unit or curriculum to engage the learner in order
to affect their performance (Bandura, 1978; Ulstad et al., 2019). As instructors’ predictions of motivation are aligned with students’ self-evaluation on their own self-determined motivation, it can be postulated that, instructors are better able to design more effective curriculum to meet these needs, when the learner’s levels of motivation are discerned through observational assessments and data.

The Flipped Classroom

The flipped classroom model (FCM) is an instructional model that has very much come into prominence over the past two decades as educational technology has advanced and been utilized in some very meaningful ways to enhance the model (Ferriz-Valero et al., 2022). The New Media Consortium (2018) acknowledged that the flipped classroom is an effective strategy to reach students and change the roles of teachers to facilitate new approaches in education. This section will (a) situate the flipped classroom model, (b) offer the components of the FCM, (c) explain the theoretical foundations of the FCM, and (d) discuss the advantages and disadvantages of an FCM design.

Flipped Classroom Model

The FCM utilizes a flipped lesson approach in order to effectively change the dynamic of a traditional passive learner, lecture style lesson, to a more dynamic active learner interacting with an “expert” type of experience. The FCM is a differentiated lesson more tailored for each learner’s needs according to the framework (Bergmann & Sams, 2012). The fundamental differences here being that the role of the teacher and the learner are quite different in an FCM as opposed to a traditional lesson format. The traditional role of the classroom teacher is that of a lecturer. In the FCM this shifts to what is often termed as an “expert” whose main role is to facilitate the lesson and ensure
that students’ needs are being met and nurtured in a differentiated way (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). The student’s role is typically one of being a passive learner, however in the flipped class setting, this shifts to a more active role where the learner is offered more autonomy and freedom with their learning in terms of pacing and scheduling with varying degrees of flexibility (Bergman & Sams, 2012). The typical in-class material from a traditional lecture-style lesson becoming a pre-class set of assignments and shifting the in-class time being used for clarification and differentiation (Alexander, 2018; Aşıksoy & Özdamlı, 2016; Chang et al., 2018; Isaias, 2018). This model targets more of the motivational aspects of learning, and layering in an incredible number of student-focused strategies and components to create a more engaging learning environment. This is where the various components of the FCM come into play.

**Components of the Flipped Classroom Model**

In order for the FCM to be sustainable and function, there needs to be certain components in place for this to happen. Each one of these plays an important role in the learning process. Each one of these components is meant to create a more effective learning experience for learners and engage the process in an active, more differentiated way. In order to properly assess the effectiveness of this, we looked at this typically outlined as the three parts of the FCM framework (Gilboy et al., 2015; Glance et al., 2018; Schmidt & Ralph, 2016; Tucker et al., 2016). These three points are as follows (a) pre-lesson materials, (b) during allocated class time, and (c) post-lesson follow-up.

**Pre-lesson materials.** As each lesson is introduced prior to the face-to-face meeting of students and teacher, materials are prepared and readied for the process to
begin. The pre-lesson material as Gilboy et al. (2015) describes, is seen what (Glance et al., 2018) terms the “learn” or as the first part of “The LEE model: Learn, expand and engage”, which as Tucker et al. 2016 posits is the inquiry and exploration portion of the lesson. Regardless of how this portion of the lesson is termed, the takeaway from it is simply that this is the point where the learner is viewing the material in an effort to learn and engage in it. This is what Schmidt and Ralph (2016) see, from the student perspective as the, “I do” phase of the work. This is where students are viewing the materials and preparing any queries that they might have for clarification during the upcoming class time. As students are able to do this at their own pace before the lesson and revisit the materials as much as they need to, this is an incredibly beneficial time offering a personalized learning experience for the learner (Bergmann & Sams, 2009; Clark et al., 2016; Enfield, 2013; Schmidt & Ralph, 2016). This also prepares students for the meaningful tasks that lay ahead such as collaborative opportunities and outlines what individuals need to prepare in order to make this a success (Jeong & González-Gómez, 2016; Keller, 2017). This ultimately is the foundational step in the process and heavily influences the outcome of the face-to-face lesson.

**During allocated class time.** After the learners have viewed the pre-lesson materials, they enter the class and begin applying and demonstrating the theories and skills that they have learned. The “during” as Gilboy et al. (2015) calls it, is the transfer of information and engagement in the material (Tucker et al., 2016). This is an opportunity for the learners to take the “I do” initial introduction to the materials and shift it towards the “we do” that is done together with the teacher during the face-to-face lesson (Schmidt & Ralph, 2016). This time is meant for clarification and application, to
take what the student has learned and put into practice the skills and theory that they have learned from the previous step. This again is where the passive learner shifts from a traditional style of lecture, to being an active participant, with differentiated help from the teacher-facilitator, to assist and guide them through the learning process (Petress, 2008; Swiderski, 2011).

Students during this time are able to expand what they have learned and compare with their peers, the potential interpretations of how best to approach a problem or a task through collaborative opportunities (Jeong & González-Gómez, 2016; Keller, 2017). During this time of engaged learning, we can also see a shift to higher order cognitive skills being developed (Batastini, et al., 2018; Bishop & Verlager, 2013; Clark, et al., 2016; Mok, 2014; Schrlau, et al., 2016). This is a direct result of the teacher-expert being available for differentiated help according to the research (Bergmann & Sams, 2009; Al-Sudais, 2019). This is where the term “expand” from the LEE model according to Glance et al. (2018) finds its place.

**Post-lesson follow-up.** After the face-to-face lesson is finished, students will then complete the lesson by doing what Gilboy et al. (2015) calls the post-class follow up. This is a time when the learner sees the most benefit from the framework. The shift from “we do” to “you do” is one of great value for the learning process. Students have time to reflect and understand the process from the previous two steps and now extend and apply the theories and tasks that they have come to learn (Tucker et al., 2016). They are at this point engaged according to the LEE model and motivated as active learners. This is also the stage in which there will be some form of summative assessment. This now occurs after two stages of formative feedback, particularly in the second phase, the most critical
one for this type of feedback, and the culmination of what has been learned is showcased. Confidence and stress is also likely to be far less as the learners have had the opportunity to clarify and understand better the techniques and tasks they were assigned. An added benefit for students with the FCM is that the materials are all easily accessible for their review (Bergmann & Sams, 2009; Clark et al., 2016; Enfield, 2013; Schmidt & Ralph, 2016; Roehl et al., 2013). This contributes to the success of students and ensures that another layer of measures are in place to facilitate the efficacy of the framework and more specifically, learning.

**Foundations of the Flipped Classroom Model**

The FCM design when viewed through the constructivist lens, is a natural and obvious fit (Al Salami et al., 2017; Herro, & Quigley, 2017; Herro et al., 2017; Liao, 2016). “Piaget emphasized, that new knowledge is built on prior knowledge as learning is developed through exploration, and on individual construction of meaning” (Neutzling et al., 2019, p. 757). Knowledge is built on the interpretations of the learner, based on their environmental interactions and observations (Pritchard & Woollard, 2010; Neutzling et al., 2019). According to Neutzling et al. (2019) Vygotsky goes further to suggest, “that new knowledge and skills are created as learners interact with each other and make sense of differences between their current knowledge and new experiences” (p. 757). Constructivism explains how language, and meaning are formed through experiences and therefore are developed through them (Fosnot, 2005). In identifying the three main pillars of Constructivism, learning is focused on how it is constructed to promote problem solving and help with critical thinking. Past experiences can be applied to new knowledge in different environments and contexts, while highlighting how knowledge is constructed
through interactive processes to connect the learners in various social settings (Rovegno & Dolly, 2006).

Having an FCM framework facilitating understanding of concepts through a three-stage process, where each aspect builds upon the previous, in order to engage critical thinking skills and offers autonomy to learners, facilitates direct inquiry and follows a Constructivist approach. This occurs due to the nurturing of the learner’s engagement to seek out answers and explore the problem through an FCM design (Keane, & Keane, 2016). This enables students to work together to further engage and deepen their understanding in the task (Jeong & González-Gómez, 2016; Keller, 2017). The ability to collaborate and grow their understanding and experiences.

**Advantages and Disadvantages of the Flipped Classroom Model**

As is the case of any instructional or design method, there are advantages and disadvantages that arise from the FCM design. The findings in favor of or against are such that success is reliant on the delivery as will be explained in the following sections, (a) advantages of the FCM and (b) disadvantages of the FCM.

**Advantages of the Flipped Classroom Model.** When identifying advantages of the FCM, there are several facets to this. Primarily, it is critical to understand and evaluate what the learner’s experience is and how it impacts them. In the case of this design, the FCM, due to the nature of the pre-class assignments, class time is more effectively utilized for activities and more active learning versus the traditional format where learners are passive in their learning, listening to the teacher tell them what to do and thus leaving less time for activities during class time with the expectation to take the skills learned and apply them to homework (Isaias, 2018; Mazur, 2009; Sookoo-Singh &
Boisselle, 2018). Understandably the traditional lesson leaves students less engaged and with lower motivation from the lesson while the FCM lesson outcomes are such that students are encouraged and excited to participate in an active class as noted by Ferriz-Balero et al. (2022).

Access and availability to the class material and lessons in this format are as Roehl et al. (2013) allude to, conducive to learning and engagement. The autonomy to select when and where to view the pre-class lesson or material, demonstrate benefits to learning and help engage learners (Bergmann & Sams, 2012; Enfield, 2013; Roehling et al., 2017). Students are able to access the information after the face-to-face lessons as well for review. This is particularly beneficial regardless of if all students utilize this or not, as there is a level of comfort knowing that material missed is not lost (Bergman & Sams, 2012). This is incredibly beneficial to students who are possibly ill or absent on the day of the lesson to access what has been learned and not get left behind.

Ideally, students need to be well supported in their academic endeavors, the FCM design inherently offers this. By having access to materials online and readily accessible, an additional layer of support is available (Roehl et al., 2013). Parents, guardians, tutors etc. are all able to access the lesson and help the student comprehend the task or what is being asked of them. This enables opportunities beyond the teacher to seek out help and clarification (Bergman & Sams, 2009; Schmidt & Ralph, 2016). This offers clear benefits for learners as outlined in the research.

Benefits of being able to access information at any time go beyond simply helping an individual comprehend a task; the accessibility enables students’ autonomy to pace themselves and learn at a pace they are comfortable with (Bergmann & Sams, 2009;
Clark et al., 2016; Enfield, 2013; Schmidt & Ralph, 2016). When students have access to all resources and materials outside of class time are more likely to find higher levels of motivation and engagement when it comes to learning the assigned material (Alexander, 2018; Aşıksoy & Özdamlı, 2016; Chang et al., 2018; Isaias, 2018). This is also a review tool that helps with retention and understanding (Bergmann & Sams, 2012; Enfield, 2013; Jeong & González-Gómez, 2016). This is particularly the case when it is done so on the terms of the learner’s convenience.

As indicated previously, autonomy is critical to the engagement of the learners in the FCM design, according to Jeong and González-Gómez (2016), and Keller (2017), there are a lot of benefits for this model in terms of collaborative opportunities and more personalized learning. Collaboration is essential for growth and understanding, while having the ability to create a more personalized learning experience feeds into the understanding of the material (Jeong & González-Gómez, 2016). This is an essential part of the process in this technology integrated climate that today’s learners are currently operating in and builds motivation towards learning.

Given the FCM offers autonomy with pacing, and the needs of each individual are varied, being able to differentiate the curriculum is another important aspect of the design. Bergman and Sams (2012) identify the importance of tailoring lessons and materials to the individual learners. Utilizing the FCM’s capabilities of pre- during and post-class components, ensures that the needs of learners is better met than it is in the traditional style of lesson (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). These strategies are what creates the opportunities for the teacher to give more help to individuals on specific tasks or concepts that they may not have fully understood,
or need clarification on (Bergmann & Sams, 2009; Al-Sudais, 2019). Acting as an expert available to students during the lesson, rather than the lecturer where learners are passively listening and meant to follow what is being taught are left at the end of the lesson to process everything that has been learned and take it with them (Kay et al., 2019; Gomez-Lanier, 2018; Sookoo-Singh & Boisselle, 2018). Having already had the time to process and come to class with clarifying points is more conducive to learning and understanding.

**Disadvantages of Flipped Classroom Model.** Despite the majority of research indicating that the FCM predominantly benefits learning and increases motivation and engagement, there are some shortcomings to the model. The challenges that will be discussed are centered around creation of resources, teacher resistance towards new initiatives, as well as creating a culture of commitment to the pre- and post-class assignments.

When changing one’s pedagogical and teaching practice, there are always challenges that go along with the amount of work that needs to take place in order for those changes to come to fruition. The FCM is no exception to this and the development of resources geared to this model are such that it should be expected that there is a considerable amount of time to be spent on building these resources (Bergmann & Sams, 2012; Clark et al., 2016; Enfield, 2013; Isaias, 2018; Tucker et al., 2012). In order for an educator to create these resources, there will need to be a fair amount of time allocated to this process. This in itself can act as a pretty strong deterrent, especially for those more traditional leaning teachers who are used to the lecture to passive learner format. Hunley
(2016) expressed this as teachers feeling that the issues to create a flipped classroom environment were perceived as too much or not feasible, logistically speaking.

Time is a major contributing factor when it comes to the efficacy of building a FCM curriculum. There is a level of commitment to time outside of the normal school hours that is likely to occur (Bergmann & Sams, 2012, Enfield, 2013). Practitioners are likely to spend a considerable amount of time building and accumulating resources in order to create this curriculum. The efficacy of it will depend on the abilities of the individual and the eagerness to devote holidays and breaks towards this process.

Arguably the biggest obstacle in a shift from traditional lecture style, passive learner format to a more dynamic and actively engaged learning environment, is the conscious shift that the educator needs to make from lecturer to facilitator (Baker & Hill, 2017). This is not a comfortable shift for many and to some degree, justifiably so. This is to say that in general, assessment outcomes do not demonstrate significant differences in test scores; where the differences are is through the engagement and participation of students in the learning process (Davies et al., 2013; Ferriz-Valero et al. 2022). Classes are more dynamic, but with the outcomes being the same, for some, there is no reason to shift if the result is the same, almost added work that seems unnecessary.

Creating a classroom culture is a significant step in any pedagogical practice and since there are three distinct elements to the FCM model as opposed to the traditional two elements, there is an additional layer of challenge to deal with (Clark et al., 2016; Roehling, et al., 2017; Sookoo-Singh & Boiselle, 2018). A critical component of the FCM is the pre-class assignments that need to be completed before coming to class. Classes are quite dependent on the students completing this side of the lesson. Without
the background knowledge and information, class time can be wasted. In order for this not to happen, a culture of commitment needs to become the norm (Clark et al., 2016; Roehling, et al., 2017). This can be challenging for students depending on the strategies that the teacher employs. There are many factors that may contribute to a negative culture; tasks are too challenging, not interesting, no accountability or follow-up when they arrive in class. All of these can lead to challenges implementing a positive class culture, committed to learning the material.

Even with careful attention, there are still those students who will not partake in the pre-lesson activities and due to that will come to class unable to contribute in a positive way. Therefore, if strategies are not in place to deal with this likely scenario, then larger problems could arise amongst students on reasons of equity (Clark et al., 2016; Roehling, et al., 2017). This is something that through thoughtful consideration can be dealt with, and it is critical to do so in order to avoid larger issues from developing.

Developing accountability can be difficult, especially when the learning taking place outside of class is out-of-sight (Mull, 2012; Sookoo-Singh & Boisselle, 2018). That is why it is important to start from the beginning and acknowledge to students that there will be check-ins and other means in order to make them accountable for their own learning.

Finally, the pre- and post-class assignments may be inaccessible simply due to accessibility issues for students (Danker, 2015; Roehling et al., 2017). If students do not have reliable internet connections or lack computers or other technology to access the course, then they are not likely to be able to partake, in that case, what solutions are there for those students? Of course, there are always solutions, but again, going back to
allocated time for the instructor is limited and coming up with viable solutions for every scenario is a different challenge.

**Transdisciplinary Curriculum**

Transdisciplinary curriculum, such as STEAM, is critical in promoting creativity while engaging student motivation for learning. Transdisciplinary education, through the SDT lens, is designed to appeal to the learner’s engagement and understanding of a topic or theme, while focusing on increasing their level of motivation within real-world, problem-solving contexts (Herro & Quigley, 2017; Herro et al., 2019; Quigley et al., 2017). Through this, students have demonstrated increased innovation and creativity towards specific STEAM units anchored in engineering and technology while highly engaged in the learning process (Malone et al., 2018). Within the curriculum, STEAM offers students the opportunity to be creative, while nurturing their engagement and applying daily-life, problem-solving skills (Wandari et al., 2018). The integration of STEAM as a transdisciplinary learning model is critical in nurturing creativity amongst students while engaging their interest and learning potential, inherently leading to more motivated learners. This section will (a) define what transdisciplinary means in the context of this research, followed by (b) a comparison between trans- and inter-disciplinary curriculums will be explained and situated in respect to this study, (c) The reinforcement of the importance of transdisciplinary curriculum will be emphasized, and finally, (d) the connections as to the importance of a transdisciplinary curriculum on PE education to conclude this section.

**Defining Transdisciplinary**
According to Nicolescu (2005) the term “transdisciplinary” was first formalized by Piaget in 1970. Transdisciplinary learning posits, in terms of its applications to education, that the learner has the opportunity to create and make connections between disciplines or subjects. Transdisciplinary learning is designed to offer freedom to work without specific domain attachments, (ie: Science, Math, etc). In essence, transdisciplinary learning allows the individual to determine how they approach a given problem or task, while designed to offer freedom to work without specific domain attachments. The learner is able to decide which domain, or domains that best serve them in addressing and solving real-world problems or tasks (Quigley et al., 2017). This is an effective tool in creating motivation for learning, by encouraging students to seek out the solution themselves or in a small cooperative community, unrestricted by traditional subject domains. Here they are in fact able to utilize subjects as they see fit in order to draw conclusions and results and are in-turn supported and encouraged by instructors to do so (Al Salami et al., 2017; Herro, & Quigley, 2017; Herro et al., 2017; Liao, 2016).

**Comparisons Between Trans- and Inter-Disciplinary Curriculum**

Although subtle, the difference between *transdisciplinary* and *interdisciplinary* curriculum are linked to curriculum design. This determines the path that the learner takes. Understanding the fundamental differences between *transdisciplinary* and *interdisciplinary* curriculum is essential to differentiate the pedagogical direction for student engagement. STEAM seems to lean in the direction of transdisciplinary, despite often being described as an interdisciplinary model. To effectively focus on the real essence of STEAM, it is important to view it as a transdisciplinary initiative. Transdisciplinary draws from all disciplines, rather than simply working between them,
as interdisciplinary learning tends to be defined by learning a common concept and how it fits within each subject domain (Al Salami et al., 2018; Makela, & Miranda, 2017; Herro, & Quigley, 2017; Herro et al., 2017; Liao, 2016). This means that the transdisciplinary learner is able to determine autonomously where their learning goes.

The importance lies within how best to motivate students to learn. In order to motivate students to take part in problem-solving curriculum, learning needs to move away from subject specific domains. It needs to transcend this by going beyond, and enabling students to learn between the traditional domains and create their own divergent thinking solutions (Liao, 2016; Quigley et al., 2017; Sharma, 2018; Tenaglia, 2017). Working between domains and allowing learners to choose their own paths will inherently motivate students to learn and achieve more. This is done through their intrinsic desire to succeed (Deci & Ryan, 2000; Quigley et al., 2017). Working within the parameters of a school system structure encourages support and more manageable pedagogical changes to be made (Sharma, 2018; Tenaglia, 2017). This creates more likelihood of buy-in by educators and enables an easier transition to cross-curricular teaching.

**The Importance of Transdisciplinary Curriculum**

Given that the STEAM model of transdisciplinary learning enhances engagement and understanding of concepts, it is suggested that this is likely to continue through the effective integration of the STEAM framework into a PE curriculum (Costantino, 2018; Li et al., 2019; Payton et al., 2017). This is likely to increase student motivation towards PL.

**The Importance of Transdisciplinary Curriculum on PE Education**
When students feel autonomy within their activities, they are more likely to have a higher degree of intrinsic motivation and in turn, higher levels of success (Jaakkola et al., 2008; Sánchez-Oliva et al., 2017; Sun et al., 2017; Ulstad et al., 2019; Van den Berghe et al., 2012). Motivation is an essential aspect of keeping learners engaged in PE and activity (Litt et al., 2011). This coupled with cross-curricular interventions or initiatives where students are able to determine their own learning outcomes through their own autonomy, aids with their intrinsic motivation and generally leads to higher level of satisfaction and success.

PL within the framework of transdisciplinary learning, offers students the ability to acquire lifelong skills that they can take beyond the classroom and apply to other contexts (Corbin, 2016; Edwards et al., 2018; Lynch, 2016; Tremblay et al., 2018; Whitehead, 2001).

**Impact of STEAM Framework**

STEAM efficacy is determined by the effectiveness of the implementation of transdisciplinary learning. For understanding, it is critical to define transdisciplinary in the context of STEAM in order to successfully implement a pedagogically sound curriculum (Herro & Quigley, 2017). Following a set curriculum based on the fundamentals of STEAM learning has proven itself viable and beneficial to student learning outcomes (Wandari et al., 2018). The effective collaboration of implementing a STEAM unit for pre-kindergarten through to grade 3 students dramatically increased the level of understanding by students and learning outcomes (Malone et al., 2018). The efficacy of STEAM learning is determined by pedagogical understanding of effective implementation of transdisciplinary curriculum. This section will postulate (a) a
contextual STEAM definition, (b) STEAM on PE, (c) review of the research on motivation, and (d) offer a research review on PL in the context of this study.

STEAM Defined

Effectively for the scope of this research, STEAM (Science, Technology, Engineering, Arts and Mathematics) will generally be regarded as, a cross-curricular, transdisciplinary education model between the Arts and Sciences, designed to develop analytical and creative thinking skills within a 21st century environment, as well as ensuring students’ opportunities for success in a rapidly changing world. PE can benefit from this cross-curricular learning approach by engaging the domains of STEAM in order to reinforce learning and understanding (Land, 2013; Teneglia, 2017; Townes, 2016). By doing so, it is postulated that the motivation of students will likely increase as transdisciplinary curriculum tends to engage students at higher levels, which in turn is likely to affect their intrinsic motivation (Deci & Ryan, 2000; DeCoito & Myszkal, 2018; Erwin, 2017; Wynn & Harris, 2012).

STEAM on Physical Education

Given that the STEAM model of transdisciplinary learning enhances engagement and understanding of concepts, it is suggested that this is likely to continue through the effective integration of STEAM into the PE curriculum. Furthermore, STEAM at the middle school level given the research, is not only applicable, it is likely to engage students and positively impact their learning outcomes in regards to standards assessed (Li et al., 2019; Payton et al., 2017).

Students find cross-curricular learning beneficial as it affects their motivation towards learning in positive ways, increasing understanding and engagement (Avramides...
et al., 2015). Taking this a step further and adding the Arts, the STEAM framework integrated into specific fitness and conditioning PE curriculum units will address this notion of deeper understanding into learning from a PE centered perspective (DeCoito & Myszkal, 2018; Erwin, 2017; Wynn & Harris, 2012).

Learning is not a passive action, when incorporated with multiple domains and done so in a thoughtful problem-solving method, the components of PL can be explored in a more meaningful way (Payton et al., 2017; Wandari et al., 2018).

Engaging students through cross-curricular curriculum such as the STEAM framework, is a necessity in order to deepen their understanding and add valuable meaning to the content that they are learning. PL is not simply isolated learning of what it is to be physically fit, rather, it is an understanding of what physical wellbeing means in the context of an emotionally, physically and mentally balanced lifestyle (Kuczala & Lengel, 2017; Li et al., 2019). Gaining a deeper understanding of concepts and essential questions, creates a need for solutions and looking outside of the traditional ways of doing things. In order to ensure the acquisition of necessary skills, vital to a twenty-first century learner, it is essential that cross-curricular opportunities are able to nurture these initiatives (Avramides et al., 2015). This is particularly true in the cases of PE and PL.

In examining course content and learning outcomes, the indications are evident that there is a need to provide support for increased cross-curricular collaboration opportunities. There is also a push towards better utilization of learning platforms available (Lee & Williams, 2015). This is in order to create a more meaningful way in which to engage students and create curricula that motivates students to learn.
Very little in the way of research focused on the topic directed specifically towards international middle school programs. For that reason, creating a case study design that examines the efficacy of PBL through the STEAM framework integrated into a fitness and conditioning PE curriculum units within an international middle school setting, is untested. Despite being untested, the evidence would indicate that students would benefit from this proposed initiative and see increased levels of engagement and motivation towards learning (DeCoito & Myszkal, 2018; Erwin, 2017; Lesseig et al., 2016; Payton et al., 2017; Thuneberg et al., 2019).

**Review of Research on Motivation**

Through the SDT lens, learning is likely to be decided by a student’s level and area of motivation. Students’ learning paths can be decided by three intrinsic domains: *competence, autonomy* and *relatedness* (Deci & Ryan, 2000). These motivational domains direct learners towards the educational path that they will ultimately take. Outcomes from a given learning framework, such as STEAM, will likely determine the path that the student decides is directly linked to their motivation, and in many cases, future careers. STEM, which in the interest of this study is the precursor to STEAM, is a cross-curricular framework designed to engage students in a multi-faceted approach to science, technology, engineering, and math. STEM has done so for a number of years and continues to do so. However, the reason that necessitates the push from STEM to STEAM is to change the levels of motivation amongst learners. This is due to the desire to engage more creativity and innovation during the cognitive processes by adding the Arts to STEM (Deci & Ryan, 2000; Herro et al., 2017; Popa et al., 2017).
Having a multi-faceted curriculum engaging in multiple domains is essential for learning and holding student interest. As noted earlier, ST®E(A)M(S) is a model designed through cross-curricular engagement to take the STEM model and offer a broader scope of effective learning (Krug & Shaw, 2016). This offers equal emphasis on innovation and other domains of STEM, all of which are designed to increase the learner’s motivation for learning. This in turn postulates the successful inclusion of PE into the STEAM framework (Herro et al., 2017; Krug & Shaw, 2016).

The design and implementation of curriculum is forged through engaging and interesting learning experiences. Effectively designing curriculum with the SDT framework’s three domains of competence, autonomy and relatedness in mind will impact the level of learner motivation (Deci & Ryan, 2000). There is great importance in conceptual and pedagogical knowledge to ensure effective design that engages learners, thus aiming to increase their intrinsic motivation. Therefore, it is critical to fully grasp the STEAM concept and invest in its understanding and implementation (Herro et al., 2017).

**Chapter Summary**

This literature review provided an overview of scholarship on PL, the flipped classroom, motivation and the STEAM framework. The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit to increase eighth-grade students’ PL knowledge at an international middle school in the Netherlands. This was an area where little data existed. The sections addressed were (a) PL, (b) motivation about PE, (c) flipped classroom model (d)transdisciplinary curriculum, and (e) the impact of a STEAM framework. This literature review framed the synthesis around (a) how motivation towards PE changes
with the integration of the FCM educational model into a fitness and conditioning PE curriculum unit, (b) how the new curriculum enhances the PL of students, and (c) what student perceptions of the new curriculum for improving motivation & PL are likely to be according to the research. With a gap in the current research in this specific area, this study aimed to contribute to the scholarship to enrich this area of research and further examine the current research on changes in motivation caused by a transdisciplinary, flipped classroom, in order to increase PL knowledge.
CHAPTER 3

METHOD

The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, physical education unit to increase eighth-grade students’ physical literacy knowledge and motivation at an international middle school.

Research Questions

The research questions that guided this study were:

**RQ 1**: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy?

**RQ 2**: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills?

**RQ 3**: What are eighth-grade students’ perceptions of how a technology blended physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?

Research Design

The proposed study utilized a mixed-methods action research design to measure the impact of a transdisciplinary PE online unit on students' motivation to learn PL. This was an appropriate design because, as O’Leary (2007) explains, the nature or the context of the study dictated which methods were best suited for the design. The focus of this
intervention is a novel FCM, transdisciplinary PE hybrid curriculum that increased students’ motivation to increase
their PL. Through the integration of several subject domains (i.e., STEAM) into an FCM unit, the study collected data through quantitative and qualitative instruments in order to determine student motivation to learn PL through a constructivist lens. Research questions were aligned with corresponding survey questions, student journals, student interviews and student observations (Wolf et al., 2016), in order to measure the change in motivation towards learning PL.

As the unit followed a technology-based FCM design, teachers’ subject domain curriculum maps, found in the institution program *Rubicon Atlas*, were utilized in order to ensure the efficacy of the transdisciplinary framework. This warranted the endeavor’s viability within the technology integrated design of the flipped classroom. The incorporation of other subject domains from students’ previously acquired knowledge impacted the perceived success of this intervention from a constructivist perspective (Arends, 1998; Avramides et al., 2015; Cukurbasi & Kiyici, 2018; DeCoito & Myszkal, 2018; Lesseig et al., 2016; Payton et al., 2017; Thuneberg et al., 2019). In order for the PE project to meet the curriculum learning outcomes for the grade, the project assessment was aligned with the grade eight middle school PE reportable standards (Appendix E). The reportable standards were a construct of the school and were not shared or regulated by a governing body such as a state or municipal school board. These standards were based upon the *Society of Health and Physical Educators* (SHAPE) standards and guidelines (Kulik et al., 2017). The outcomes from this study were used to determine the understanding that participants gain towards PL from a flipped classroom, technology integrated, PE unit.
As the participants involved directly took part in this research and were integral stakeholders in the outcome, this study fell within the parameters of the action research characteristics that distinguish it from other types of research (Collatto et al., 2018; Mertler, 2017). For this study, “action research provided a means of generating knowledge about the implementation of the initiative and using that to keep it on track as far as possible” (Somekh, 2006, p. 1) through a cyclical process (Collatto et al., 2018; Mertler, 2017).

Action research is a methodical investigation into a localized problem where stakeholders, such as the students in this intervention, have a vested interest in facilitating some form of change (Bradbury-Huang, 2010; Mertler, 2017). This is unlike other research which tends to look beyond local contexts to more generalizable findings that could be applied elsewhere to other situations or contexts (Mertler, 2017). Although this may still occur, the size and context of this study, at an international school, made action research the optimal design for the intervention.

The cyclical nature of action research, the smaller scale, and the use of reflective practices made this an ideal form of research for this particular situation afforded me, as the instructor-researcher, the opportunity to create an intervention with meaningful outcomes and affect real change on a local level within my community (Carr & Kemmis, 1986; Mertler, 2017).

This study utilized a convergent parallel mixed-methods design, where quantitative and qualitative data sources were collected concurrently to examine the efficacy of a unit over the course of a six-week period of time (Creswell & Creswell, 2018). According to Sargent and Casey (2020) there were many studies that examine the
area of FCM learning, however this was scarcely examined in the context of PE with only
two notable studies (Botella et al. 2021; Ferriz-Valero, 2022).

Determining the impact of the FCM, cross-curricular framework therefore
followed the analysis of the emergent data (Creswell & Creswell, 2018; Merz, 2002). As
the research questions and focus of the study necessitated changes, emerging themes
upon reflection started to dictate the need for re-evaluation and changes to be made
during the course of the study. This became particularly evident in the field and thus the
inquiry plans and strategies were adjusted to be responsive to the site (Merz, 2002;
Schwandt, 1997). This became a cyclical process of reflection and re-evaluation,
gathering, analyzing, and reporting that were all critical in offering substance to the
research findings (Coghlan & Brannick, 2005; Creswell & Creswell, 2018). By doing
this, the research was not forced into a specific path, but rather, naturally took its course.
This cyclical nature of action research enabled opportunities to effect real changes
through this iterative process within the local community (Coghlan & Brannick, 2005;
Merz, 2002; Schwandt, 1997). This problem of practice focused on the impact that
student motivation had towards PL knowledge through an FCM, transdisciplinary
curriculum-based, PE unit at an international middle school.

**Setting and Participants**

The setting for this research was an international middle school in the
Netherlands. As the research took place in an international school with a traditional,
instructor-led, PE program, the intent was to change the focus towards student-led
engagement and interaction directed from an FCM design. This effectively created a
greater sense of autonomy for learners while they deepened their understanding towards
the importance of PA. This was in lieu of simply being active while taking part in a specifically assessed traditional sport. The school offers a one-to-one laptop program where students access online content and resources through their device. This typically follows a traditional style lesson where concepts are introduced in class and practiced at home. The PE program followed this same model; however, the use of technology is far less in class, as the focus is on moving and being active throughout the lesson. The change to a flipped lesson format offered a broader reach to more individuals and participants in the PE program than previously experienced. A typical class consisted of starting with a warm-up game, then moving to a skills and techniques explanation, drills practice and finishing the lesson with modified games based around the skills and tactics learned in class. From time-to-time students would use technology to record a movement or task in order to analyze their techniques. This was aimed at utilizing the access that students had to technology; however, this was about the limit of usage in any given class, and certainly not on any sort of regular basis. This averaged no more than one time per three-week unit, and in most cases, only one in every three units.

It is important to note that the populations within this school were quite culturally and ethnically diverse, as well as consisting of a fairly transient population which through professional experience has demonstrated less value placed on overall PA and wellbeing (American School of The Hague, 2019). Students’ families, on average, stayed between three to five years before moving on to another posting in a different country or region (American School of The Hague, 2019). Within a given year, there was a 5–15% turnover of students each new school year. Middle school years at ASH were considered grades 5 through 8, and each year group consisted of 90–100 students depending on the
year (American School of The Hague, 2019). Therefore, there were between 360–400 students at any given time throughout the year. Among those students, approximately 26% are American, 12% were Dutch nationals, and the remaining 62% were from 74 other countries (American School of The Hague, 2019).

The study data was initially collected from 3 to 6 purposeful sample groups, each consisting of approximately 5–7 students, with a total of 31 (demographics seen in Tables 4.1, 4.2 and 4.3) (Creswell & Creswell, 2018; Palinkas et al., 2015; Patton, 2002). Each group was represented by 40–60% female students and 40–60% male students, with a goal of 50% representation in each group. As demographics were available for all students enrolled, creating stratified random sample groups of 13-year-old students was the sampling method chosen as it was representative and accessible (American School of The Hague, 2019; Nagelkerke & Borgdorff, 1999). Using stratified sampling groups allowed the study to represent the diversity of the setting and its population accurately and proportionately increasing the depth and validity of the data collected for later analysis (Creswell & Creswell, 2018; Howell et al., 2020; Palinkas et al., 2015; Patton, 2002). This was evident in the interview process as six students were initially asked to conduct the interviews, however only five students in the end were able to participate in the interviews due to scheduling and other school activities. These five students consisted of three boys and two girls (The original intent was to have three boys and three girls). The three boys’ ethnicities consisted of one European, one American and one South Asian. While the girls were two, one American and one European. This group was a random sample, consistent and representative with the group demographics. This will be discussed further in chapter four, in greater detail.
**Intervention**

The intervention for this six-week learning experience followed a transdisciplinary Flipped Classroom Model (FCM). The unit was designed to enhance the levels of PL through a technology integrated PE unit. Initially this intervention was to be delivered to grade sevens towards the end of the school year in the Spring of 2021; however, due to unforeseen circumstances, it was delivered in the Fall of 2021 to grade eights. Due to Covid 19 and the protocols that were set in place, there were many challenges faced. The Spring of 2021 was marked with online learning until the final month of the school year where students went back to school under a hybrid learning environment. There were also many protocols in place when they were at school with social distancing and the total number of students allowed in a space at any given time. The levels of physical exertion were limited as well. This being the case, the intervention moving to the following school year and targeting eighth graders at the start of the year presented itself with its own challenges from the original design of the intervention. Students were not sure if we would be returning to online or hybrid learning as case numbers escalated. As the previous year was disjointed, the STEAM aspect of the intervention could not meet its full potential, as curriculum from the previous year was heavily modified and the knowledge and skills that would have been in place otherwise, simply were not to a satisfactory level where their impact might be felt. Therefore, this aspect of the intervention did not rise to its full potential.

The aim of this intervention was to improve students’ PL knowledge and motivation for PE through a technology integrated FCM framework. The use of a technology integrated FCM model was selected because this approach yielded increased
student achievement levels (Bergmann & Sams, 2012; Bhagat et al., 2016; Florence, 2020; Sharom & Kew, 2021). The unit topics that were included in this transdisciplinary initiative were included in the following subjects based upon the STEAM model: Math, Technology, and, representing the “A” in STEAM, Language Arts and Home Economics. The STEAM subject counterparts of PE aimed to work in conjunction with the eighth grade PE curriculum in order to develop a deeper understanding towards the learning outcomes and PL. As mentioned earlier, this was not fully realized due to Covid 19’s ever-changing learning environments. From what was feasible, increased PL was the purpose for, and guiding factor of the technology integrated FCM, project-based PE unit design. This was followed by an explanation of the intervention components and how they functioned within the context of the study. The four components of the intervention were: a) pre-intervention, b) outside of class, c) during class and d) post-intervention.

**Theoretical Framework**

In this section, the theoretical frameworks that grounds the research will be discussed. The connection between relevant learning theories and the design of the intervention are explained (Table 3.4).

**Constructivist theory.** As learning is described as a student-centered process through the constructivist lens, learners actively engaged in this endeavor in a way that is reflective and relevant to their own concepts of PA and fitness through prior experiences and knowledge (Arends, 1998; Cukurbasi & Kiyici, 2018; Munafo, 2016). Constructivist theory informed the intervention as students were tasked with creating their own fitness program that serviced their needs and inclinations towards physical wellbeing. As the instructor provided guidelines rather than a specific template for learners to follow, this reinforced the constructivist perspective. Students actively learned as they worked
collaboratively during the in-class portion of the intervention. Furthermore, as the media provided to students for the FCM offered guidelines rather than specific fitness plan examples, this further supported the constructivist views where students were presented the freedom to construct their own representative version of a fitness plan.

Table 3.1
Theoretical Alignment Table

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<tr>
<th>Theory</th>
<th>Description of Theory</th>
<th>Elements of Intervention</th>
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| Constructivist Theory         | Student’s construction of meaning is gained through experience and influenced by prior knowledge (Arends, 1998). | Video lectures
                                                                      Constructing a fitness program task
                                                                      Student-centered environment                                                       |
| Self-Determination Theory     | Competence: Learner feels they can effectively partake in an activity.                  | Students will demonstrate through their ability to create a workout program.              |
|                               | Autonomy: Learner feels they are participating by their own accord.                       | Students will have control through the selection of the various activities that comprise the workout program. |
|                               | Relatedness: Learner feels acceptance by the group within the context of the activity. | Students will work together in a collaborative learning process throughout the intervention. |

**Self-determination theory.** Exponents of the self-determination theory (SDT) identify the shift from extrinsic motivation towards autonomy as an individual gains understanding and knowledge of the task that they are doing (Baumeister & Leary, 1995; Reis, 1994; Ulstad et al., 2019). During this intervention, the three pillars of SDT were addressed by students creating a fitness program tailored to their specific needs and goals (competence). Students determined their fitness program activities based on the parameters of the task and their prior knowledge, as they understand them (autonomy). Due to the collaborative nature of this intervention, learners worked together in order to expand their ideas and notions of their own fitness programs as they worked in conjunction with others (relatedness). The scope and nature of the fitness program was to
increase the likelihood of life-long participation in PA through knowledge and understanding, which in turn increased PL.

**Design of the Intervention**

The Flipped Classroom Model (FCM) was utilized in order to change from the traditional instructor-led and centered activities towards students applying prior learning from the out of class media lectures content to the learning objectives within the class context. This essentially flips the traditional model in order for the instructor to optimize time and students to work more autonomously within the parameters of the intervention task (Sargent & Casey, 2020). There were four elements that comprised the intervention: a) *pre-intervention*, b) *out-of-class*, c) *in-class*, and d) *post-intervention*. 
Table 3.2
*Intervention Design and Timeline*

<table>
<thead>
<tr>
<th>Flipped Component</th>
<th>Intervention Activities and Content</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td>Protocols and LMS overview</td>
<td>Pre-week 1 (10 days before intervention)</td>
</tr>
<tr>
<td>Out-of-class</td>
<td>Media lectures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Overview of the fitness program</td>
<td>Week 1</td>
</tr>
<tr>
<td></td>
<td>2. Building the program</td>
<td>Week 2</td>
</tr>
<tr>
<td></td>
<td>3. Program form and shape</td>
<td>Week 3</td>
</tr>
<tr>
<td></td>
<td>4. Tertiary components of program</td>
<td>Week 4</td>
</tr>
<tr>
<td></td>
<td>5. Peer feedback and help</td>
<td>Week 5</td>
</tr>
<tr>
<td></td>
<td>6. Project presentation guidelines</td>
<td>Week 6</td>
</tr>
<tr>
<td></td>
<td>Weekly learning checks for understanding</td>
<td>Week 1-6</td>
</tr>
<tr>
<td>In-class</td>
<td>Collaborative learning and idea exchange (face-to-face and online tools)</td>
<td>Each class</td>
</tr>
<tr>
<td>Post-intervention</td>
<td>Verification and approval of interview transcripts by participants</td>
<td>Within two weeks of the end of the intervention</td>
</tr>
</tbody>
</table>

**Pre-intervention.** During the initial introduction process, led by the instructor, students were made aware of the project parameters. This included familiarizing students with the LMS, the various ways to communicate, key terminology, protocols, acceptable behaviors, and task outcomes. They were also made aware of the reportable standards that they would be assessed on as seen in Appendix F.

**Out-of-class.** Using instructional digital media in the flipped class was a valuable way to augment the content of the intervention learning material in a time efficient manner as well as enabling students to differentiate the material as they worked through it prior to class (Sargent & Casey, 2020; Clark, 2015; Smith, 2015). The digital content consisted primarily of instructor created content videos, an optimal 5-10 minutes in length according to Gou et al. (2014), and uploaded to YouTube as unlisted for viewing over the weekend on the LMS, prior to students coming to class the following week (Lau
et al., 2018). YouTube was utilized as closed captioning is built into the application and allows more control and access over the content for those with visual or cognitive challenges.

Weekly check-ins were assigned with the media content for the weekends in order to ensure that students were engaged and understanding of the task presented at each stage of the intervention. The check-ins served two primary functions: 1) to assess how students understood the content from the previous week, and 2) how they interpreted the information for the upcoming week. The check-ins started from week one and continued until week six. It should be noted that the initial check-in in week one was omitted because the previous week’s assessment of understanding had no content for the task that had been covered.

All of the digital content was accessible from the school LMS through links provided on the class page, ensuring child safety and protection. Furthermore, all video content was downloadable from the LMS. These videos were made on the application *Film Maker* and, focused on various aspects of the intervention that built from one week to the next (see table 3.5). The scripts were posted on the LMS and the notes and information that accompany the videos were delivered via a complimentary Google slide show. Students needed to have their school provided laptops and headphones when accessing the class content.

In the first video, *Overview of the fitness program*, students were offered a high-level look at the task and the learning objectives. This included the project parameters and a rubric for students to utilize as a guide for assessment. The process and the
expectations were discussed during this video. Students were left to decide upon the specific workout theme that they wanted to create and how to present it.

In the next video, *Building the program*, students learned key principals and components to building a fitness program. This video offered a general conceptual idea of the fitness program framework and the steps to do so. This was where students were introduced to the collaborative process of sharing resources.

In the third video, *Program form and shape*, students had a check-in with the process explained. This was the point in the intervention where the instructor checked for understanding and ensured that students were on task. This video explained the feedback process and where to go from there.

In the fourth video, *Tertiary components of the program*, students explored additional resources and information that further added to creating more robust content and information. These elements included how to integrate their nutritional component and other complimentary facets into their fitness program.

In the fifth video, *Peer feedback and help*, students were offered strategies of how to give and receive informed feedback regarding their fitness programs (Smith et al., 2018). As this was an important aspect of the task for growth and understanding, this acted as a channel for students to advance their content substance.

In the final video, *Project presentation guidelines*, the presentation process was explained to students and what the expectations were. The intention here was to answer questions and help identify potential areas where students felt concern or apprehension.

**In-class.** The in-class intervention was the applied theoretical knowledge that students gained from the out-of-class component of the FCM. This interfaced with a
variety of online components accessible during class on the LMS course page framed as:
a) Exploration of physical activities, (b) activity selection and nutrition, (c) building a
fitness program and (d) program exhibition and promotion. The incorporation of
technology enabled participants to work in a collaborative online environment while in a
class setting.

**Phase I: Exploration of physical activities.** Students were given a series of
exemplars of practical workouts. Along with these, explanations of the types of physical
activities and what they were designed to do followed (i.e., strength training,
cardiovascular endurance, etc.). It should be noted that these workout programs were
exemplars of specific exercises and not the fitness programs that students were intended
to create, maintaining the integrity of the constructivist approach. From this point,
students worked collaboratively online with other students to compile a repository of
physical activities that met the criteria previously put forth on a Google Sheet. These
activities acted as a resource for students to analyze and determine their appropriateness
for each individual’s project, while furthering their decision making on what type of
fitness program they intended to create. The students aimed to understand the value and
function of each activity that they were inclined to select and determine how each activity
worked in conjunction with other selected physical activities. This process was an
exploratory, information-gathering endeavor to gain perspective on various physical
activities and their functions.

**Phase II: Activity selection and nutrition.** In the next step in the project, students
began to evaluate various activities that, on their initial introduction, seemed to align with
their vision of a fitness program offering them autonomy to engage them in the
intervention. As this was an iterative process of continual re-evaluation, students will continue to investigate further the value of each preferred PA that they selected. Students combined this selection process with collaborative time in order to reinforce the competence facet of the STD. During which, they discussed with their peers, through face-to-face and online opportunities, the value of the various physical activities, this addressed the relatedness facet of SDT. This was done based on their ideas and types of fitness programs that they were interested in creating. Utilizing their peers as a resource acted to engage discussion and opportunities for students to better understand and determine their ideal fitness program. During this time, students also were tasked with providing a nutrition plan that complimented their fitness program philosophy and dietary needs. Ideas, recipes, and nutrition thoughts were all discussed through online shared Google Doc. A shared Google Sheet allowed students to engage different recipes and ideas for meals and snacks, particularly as the student makeup was incredibly diverse.

**Phase III: Building a fitness program.** After having selected and finalized a series of activities, students created their full fitness program. This process included a differentiated fitness program that allowed for students to introduce their program and allowed for growth for beginners within it, as well as challenges for higher level performers. In combination with their nutrition plans, students offered a complete fitness program designed for success. Success was defined as participants in such a program, over the course of time, see the results that the program is designed to achieve. As everyone is different, students made clear that the result may differ from person-to-person, however, they enjoyed personal growth. This phase of the project included opportunities for students to offer feedback to one another about their fitness programs.
This feedback enabled students to justify and, in some cases, make edits to what they had prepared prior to showcasing it for all to see.

**Phase IV: Program exhibition and promotion.** In this last phase, students finalized their fitness program presentations and showcased their project artifacts for their peers to view. After viewing all of the various fitness programs, students took part in a peer evaluation process that offered each student thoughtful feedback on their artifacts. Students then wrote a reflection piece justifying their fitness program based on the feedback from their peers and presented their project and final reflection, based on peer feedback, as their summative assessment was graded.

**Post-intervention.** The post-intervention consisted of interview transcripts approval by the participants. According to Mero-Jaffe (2011), this was an opportunity for the participants to clarify information, correct mistakes or add to their responses. A critical component in the interview process ethically and for transparency.

**Conclusion**

The flipped classroom was designed to enable students to come to class prepared and engage in this learning intervention. Through the constructivist lens, learners were able to apply previously learned knowledge and apply it through a transdisciplinary framework (STEAM) to the construction of a holistic fitness program. By doing so and utilizing the online tools available, students were able to work through this task collaboratively while maintaining their autonomy through choice and presentation.

**Data Collection Methods**

Using an emergent design path, data was collected in order to explore how an FCM PE unit affected students’ motivation towards understanding of PL. Pre- and post-intervention questionnaires collected quantitative data at the beginning and end of the
intervention to measure changes that occur pre- and post-intervention. Qualitative data was collected from student interviews, student journals, and student observations throughout the intervention (Creswell, 2018; Kuhs et al., 2001; Merriam & Tisdell, 2016; Mertler, 2017; Somekh, 2006). Students interviews and observations were recorded by the researcher, and the journals were completed through a shared Google Doc. The research questions and data collection methods are summarized in Table 3.3.
Table 3.3
Outline of Research and Data Collection Methods

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>How and to what extent does a technology integrated,</td>
<td>Motivated Strategies for</td>
</tr>
<tr>
<td>flipped classroom, physical education unit, enhanced with the STEAM model,</td>
<td>Learning Questionnaire</td>
</tr>
<tr>
<td>impact eighth-grade students’ motivation to learn about physical literacy?</td>
<td>(MSLQ) with 31 items</td>
</tr>
<tr>
<td></td>
<td>Student interviews</td>
</tr>
<tr>
<td>How and to what extent does a technology integrated,</td>
<td>Canadian Assessment of</td>
</tr>
<tr>
<td>flipped classroom, physical education unit, enhanced with the STEAM model,</td>
<td>PL second edition</td>
</tr>
<tr>
<td>impact eighth-grade students’ physical literacy skills?</td>
<td>questionnaire (CAPL-2)</td>
</tr>
<tr>
<td></td>
<td>Student interviews</td>
</tr>
<tr>
<td>What are eighth-grade students’ perceptions of how a technology blended physical</td>
<td>Student interviews</td>
</tr>
<tr>
<td>education curriculum, enhanced with the STEAM model, impacted their physical</td>
<td>Student observations</td>
</tr>
<tr>
<td>literacy skills?</td>
<td>Student journals</td>
</tr>
</tbody>
</table>

Student Questionnaires

Quantitative data was collected through two questionnaires (Appendix A) that were from two existing instruments: (1) MSLQ and (2) CAPL-2. Both of these were established and reliable instruments used for gathering data which can be applied to middle school students (Holland et al., n.d.; Longmuir et al., 2015; Longmuir et al., 2018; Meijs et al., 2019; Pintrich et al., 2004; Soemantri et al., 2018; Tremblay et al., 2018).

The questionnaires delivered to students consisted of two established instruments. (See Appendix A).

First, the MSLQ was used to measure students’ motivation for learning (Erturan-Ilker et al., 2014; Pintrich, 2003; Pintrich et al., 1991). The MSLQ is made up of two sections: 1) Motivation and 2) learning strategies. For the purposes of this study, only the 31-item motivation section was used as it measured value, expectancy and affect as reported by students (Pintrich et al., 2004). The second section of the MSLQ is aimed at
cognitive, metacognitive and resource management evaluation by students and not utilized in this study, therefore it was not used (Pintrich et al., 2004). The MSLQ is made up of six sub-domains: 1) Intrinsic goal orientation, 2) extrinsic goal orientation, 3) task value, 4) control of learning beliefs, 5) self-efficacy for learning and performance, and 6) test anxiety. The MSLQ has been reported as reliable and valid, which supports its use in this research (Holland et al., n.d.; Meijs et al., 2019; Pintrich, 2003; Pintrich et al., 1991; Soemantri et al., 2018). Following the guidance of the Cook, Thompson, and Thomas (2011) model, participants completed the MSLQ prior to the PE unit and once again after the PE unit has concluded. The Cronbach’s alphas for the MSLQ total and domain scores were: Intrinsic goal orientation .74; extrinsic goal orientation .62; task value .90; control of learning beliefs .68; self-efficacy for learning and performance .93; and test anxiety .80, in terms of reliability (Ilker & Arslan, 2014). This supported the use of this instrument as valid and reliable (Cook et al., 2011). The MSLQ contains two parts: Part A: Motivation and Part B: Learning strategies, and the two sections are designed to address both cognitive and metacognitive strategies (Erturan Ilker et al., 2014; Holland et al., n.d.; Meijs et al., 2019; Pintrich, 2003; Pintrich et al., 1991; Soemantri et al., 2018). In total, there were 81 items in the MSLQ. However, for the purposes of this research, only Part A was utilized for data collection due to its relevance. Certain items were slightly modified to meet the specific needs of this study. For example, the original item “When I take tests, I think of the consequences of failing” was reworded to “When I deliver a presentation, I think of the consequences of failing” to mirror the activities of the study. It should be noted that the MSLQ items were altered by changing the term “test” to “presentation” in items 3, 8, 14, 19, 20, and 28 to align with the assessment used
The value components scale was further broken down into three subscales: *Intrinsic goal orientation, extrinsic goal orientation* and *task value*. *Intrinsic goal orientation* refers to the reason that the individual is engaging in the learning task. This subscale references the course or subject in its entirety, not one specific aspect of it. This was represented by questionnaire items 1, 16, 22 and 24 (Pintrich, 1991). *Extrinsic goal orientation* focused on items 7, 11, 13 and 30 which were based upon learners participating in activities based on external or outside factors, such as grades or assessments (Pintrich, 1991). The subscale of *Task value*, was the value that students place on a given task. How interesting or useful that it was. High task value increases the involvement of a student in their own learning.

The questionnaire was given as a Google form to students pre- and post-intervention. The MSLQ was used to measure an individual’s motivation towards learning. This questionnaire was the instrument used to measure the change in motivation towards increasing PL knowledge through a technology integrated, FCM design, PE unit.

Second, the CAPL-2 was used to assess a wide variety of skills and abilities that constitute PL. This was made up of four sections: 1) Motivation and confidence, 2) physical competence, 3) knowledge and understanding and 4) physical activity behavior (Longmuir, 2013). For the purposes of this study, only two of the four sections were used, motivation and confidence, and knowledge and understanding and the other two sections were physical skills observed with testing that were not applicable to this aspect of the study. There were no sub-scales for the knowledge and understanding domain, while there were four sub-scales for the motivation and confidence domain and they were: 1) Predilection, 2) adequacy, 3) intrinsic motivation, and 4) physical activity
confidence. The CAPL-2 was regarded as a reliable instrument which will be explained in more depth later in the chapter (Holland et al., n.d.; Li et al., 2020; Longmuir et al., 2015; Longmuir et al., 2018; Meijs et al., 2019; Pintrich et al., 2004; Soemantri et al., 2018; Tremblay et al., 2018). Within the two sections measured, there were four domains of PL. These four domains were: 1) Physical Competence, 2) daily behavior, 3) motivation and confidence, and 4) knowledge and understanding. To measure these four domains, the CAPL-2 consists of a 25-item indicator assessment (Gunnell et al., 2018). It was reported to be valid and reliable (Longmuir et al., 2015; Longmuir et al., 2018). The Cronbach’s alphas for the CAPL-2 total and domain scores were: Motivation and confidence .90 and knowledge and understanding .52 (Li et al., 2020). See Appendix A for the full instrument including the modifications as mentioned.

**Student Interviews**

Interviews were conducted in order to engage the participants in a conversation focused on the study and enabled the researcher to access things that could not be directly observed, such as the feelings or thoughts of the participants for each of the research questions identifying motivation and student understanding of PL (Merriam & Tisdell, 2016). Interviews provided opportunities to explain any abnormalities or inconsistencies found within the data collection process (Kuhs et al., 2001). Through carefully crafted prompts, an opportunity to probe student experiences was created and follow-up queries lent themselves to gain more insight into the experiences of learners during the intervention. (See Appendix C for full interview protocol) Questions following a semi-structured approach were utilized in order for the student interviews to evolve in an organic and meaningful way. According to Merriam and Tisdell (2016), having a set of
questions guided by a list of topics, or issues noted within the research area, makes for an effective semi-structured interview process. Therefore, the semi-structured format allowed for some movement within the development of the interview through a flexible ordering of questions framework. Within this process, there were specific data required from the respondents, and therefore, necessitated the need to follow this semi-structured format (Doody & Noonan, 2013; Kuhs et al., 2001; Mertler 2017; Merriam & Tisdell, 2016).

Referring to Patton’s (2015) model of six types of questions, a list of interview questions was compiled in order to address the appropriate types of questions for this intervention (see Table 3.3). The questions for this instrument were compiled based on the literature. Since the context of this study, with its given parameters, were quite novel, finding specific instruments in the literature was difficult to align in a meaningful way. Therefore, guided by the literature, twelve questions were designed to align with the three research questions as demonstrated in Table 3.3. In designing the questions, certain fundamental components needed to be applied. According to Merriam and Tisdell (2016), unstructured interviews are incredibly useful in the context of this intervention, as this study aimed to measure the change in motivation towards learning PL. Since this method was used in conjunction with student observations (Mertler 2017; Merriam & Tisdell, 2016). Examples of interview questions are: In what ways has technology helped you access resources and information about PA? Please explain how it did this. In what ways has your motivation changed your engagement in learning about PL in this unit? (See Appendix D for the full interview protocol).
Some shortcomings to the interview process were that it sometimes could be difficult to make connections between the different responses from the various participants. With carefully constructed questions, this issue could be kept to a minimum as long as the responses of the participants were probed and explored (Doody & Noonan, 2013).
<table>
<thead>
<tr>
<th>RQ 3</th>
<th>In what ways has the new physical education unit helped you access resources and information about physical activity? Please explain how it did this.</th>
<th>Do you think that the new physical education unit has changed your understanding of physical literacy? Please explain how.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>How effective has the new physical education unit been in helping you gain a better understanding of physical literacy? How has the new physical education unit changed your understanding of physical literacy? How has your understanding of physical literacy changed over this unit? In what ways has your motivation changed your engagement in learning about physical literacy in this unit? Do you feel that this physical education unit helped to motivate your learning of physical literacy? Please describe the ways in which it did or did not motivate your learning of physical literacy. Have you found that the new physical education unit has motivated you to learn in this unit? In what ways? How do you think your motivation towards learning about physical literacy has changed? With a better understanding of physical literacy, what will be your next steps? Where do you see this change or these changes taking you in regards to your understanding of physical literacy and being more physically active?</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.4
Alignment Between Research Questions and Interview Questions
**Student Journals**

The purpose of the student journals was to provide insight on the weekly workings of the implementation of the PE unit (Mertler, 2017). Student journals were an essential component in the research that aligned with and supported the student interview and observation process. The student journals were designed to engage the students’ metacognitive understanding of the PE unit and its impact on their motivation towards learning PL (Henter & Indreica, 2014). Having that deeper understanding of how the intervention was affecting and influencing their learning paired well when interviews that took place and probing questions were asked. When responding to journal prompts, students were able to articulate their feelings, thoughts, and views in a more focused way having first written about them prior to the interviews (Henter & Indreica, 2014). The journal prompts can be found Table 3.4.

As journaling is a reflective process, students needed to be taught about the process and the intended outcome of it. Therefore, there were introductory sessions to explain and outline what the expectations were of the journals. During the intervention, participants were given open-ended journal prompts based on various aspects of the intervention, and responded on a Google Doc (Cutforth & Parker, 1996). The Google Doc allowed better access with its assistive technologies that were integrated into the application to incite higher levels of participation. This process encouraged participants to make real-world connections with the lessons they had just participated in (Graffam, 2003). The submitted journals acted as a means of offering the researcher some guidance for the preceding steps in the intervention as part of the action research cycle (Mertler, 2017). Prompts were based on ten PL questions designed by Longmuir and Tremblay (2016). Most of these questions aligned with research questions three as well as the four
themes of PL as described by Tremblay and Llyod (2010). This alignment of the journal prompts and the research questions can be found in Table 3.4. The writing prompts were meant to elicit deeper thinking, while aligning with the learning outcomes. They were also written in a way that was easier to follow for the participants (Cohen, 2016; James, 2005). The prompts were coded as journal prompt week (JPW) followed by a number that corresponded to the week that they were administered during the intervention.

**Table 3.5**

Alignment Between Research Questions and Journal Prompts

<table>
<thead>
<tr>
<th>RQ 3</th>
<th>JPW2: Working together to build resources can be helpful, especially using the right tools. Do you feel the process has impacted your motivation to learn physical literacy? In what ways do you feel working with others increased your desire to be more active? In what ways do you feel it lowered your desire?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JPW3: In what ways have you been able to connect your other classes to this physical education unit to help your physical literacy? Please describe and expand.</td>
</tr>
<tr>
<td></td>
<td>JPW4: How does connecting other classes to physical activity help you learn physical literacy in this project? Please offer some examples.</td>
</tr>
<tr>
<td></td>
<td>JPW5: How do you find projects like this change your motivation to learn about physical literacy? (Does it increase or decrease? Why or why not?)</td>
</tr>
</tbody>
</table>

*Note: JPW= Journal prompt week*

**Student Observations**

Student observations were utilized for two distinct reasons that differentiate them from interviews. First, they occur in the location of where the intervention was taking place, and second, observations represent a first-hand account from the researcher’s perspective (Merriam & Tisdell, 2016). This was a critical component in the data
collection process as it was often intertwined with interviews in order to fill in many of the gaps that could possibly arise from only conducting interviews. Observations were based upon an interpretation of Haerens’ (2013) *List of Observed Need-Supportive Teaching Behaviors* model. (See Appendix D). This framework offered a reliable way to observe participants during the intervention. To paraphrase Patton’s (2015) analogy, a research-related observation compared to an everyday-type observation is the same as a professional versus an amateur. Therefore, just as it was important to align interviews with the research questions, the same is true for the observations. This ensured that the research questions provided a basis to start the observation process from. The intention of the observations was to focus on a few areas according to Merriam and Tisdell (2016), including the physical setting, the participants, and the activities and interactions. As argued by Merriam and Tisdell (2016), many challenges present themselves when trying to pre-determine the effective amount of time required for conducting observations prior to doing it. Therefore, an allocated time slot of one hour maximum was made. Each hour observation was broken into four 15-minute blocks. There were a total of four observation periods during the course of the intervention. These observations took place throughout the six-week intervention, (weeks two, three, five and six). The process of collecting data was determined during the course of the procedure. More specifically, as noted by Schensul and LeCompte (2013), the premise that you need to be open-minded entering the process is critical. Early impressions, in conjunction with the research questions, shape the observations, which in turn acted as a source of guidance throughout the data collection process.
A written account of the observation was detailed with field notes. Generally, the researcher’s role was that of a complete observer, or, from time-to-time, an observer-as-participant. This enabled more detailed field notes to be taken during observations and, as soon after as possible, the remaining details were recorded so as not to miss or forget data (Schensul & LeCompte, 2013). Observations began with the participants working on their projects. The observer walked around and recording data on the observation checklist. Field notes followed a repeated format in order to maintain consistency as well as track information easily outside of the observation checklist in order to fill in any gaps that might arise in the data. The observation checklist can be found in Appendix E.

**Data Analysis**

In this mixed-methods study, four data sources were analyzed: 1) Pre- and post-intervention questionnaires, 2) student interviews, 3) student journals, and 4) student observations. The alignment of the research questions with these data sources and data analysis are outlined in Table 3.6.
Table 3.6
Research Questions, Data Sources, and Data Analysis

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy?</td>
<td>• Motivated Strategies for Learning Questionnaire (MSLQ) (pre- and post-intervention questionnaire)</td>
<td>• Descriptive Statistics ($M$, $SD$, range)</td>
</tr>
<tr>
<td></td>
<td>• Student journal responses</td>
<td>• Paired samples t-test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills?</td>
<td>• Canadian Assessment of physical literacy second edition (CAPL-2) (pre- and post-intervention questionnaire)</td>
<td>• Descriptive Statistics ($M$, $SD$, range)</td>
</tr>
<tr>
<td></td>
<td>• Student journal responses</td>
<td>• Paired samples t-test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are eighth-grade students’ perceptions of how a technology blended physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?</td>
<td>• Student interviews</td>
<td>• Inductive Analysis</td>
</tr>
<tr>
<td></td>
<td>• Student observations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Student journals</td>
<td></td>
</tr>
</tbody>
</table>

Student Interviews

Following the qualitative data collection process, student interviews were analyzed using inductive analysis with the constant comparative method. This was done in order to develop a deeper understanding and meaning of the qualitative data results gained from interviews and develop themes from the data. As Glaser and Strauss (1967) highlight, this was used to assess the qualitative data and create categories and themes that through analysis led to the creation of a theory. As Saldaña (2009) indicates, “data are not coded, they’re recoded” (p. 45), implying that this will be an ongoing process of refinement and reduction. The qualitative data was analyzed through a multi-stage,
thorough process of first organizing and preparing the data. Next, the reduction and coding of the data utilizing an *in vivo* process was done and facilitated by using Delve software, a qualitative analysis application. Utilizing this application allowed for the compilation of codes and themes to be made in an easy-to-view format (Belotto, 2018).

The coding process allowed for large segments of data to be analyzed in different ways (Belotto, 2018). These codes were then reduced further to common categories and themes using an emergent coding process. This allowed themes to emerge from the data collected (Mertler, 2017). The final step in the coding process was representing the findings of the data, and authentication of the emergent themes (Creswell & Poth, 2018; Mertler, 2017). Following the coding process, emerging themes were authenticated in order to align them to the research questions. This aided in determining, through deep analysis, how these themes relate to the research questions (Stuckey, 2015).

**Student Journals**

The process by which the student journal entries were analyzed was directly from a Google Doc, created by the participants, that was shared with the researcher. Using a similar process as discussed in the previous interviews and observations sections, the journal entries were coded using inductive analysis, and were further reduced using an emergent coding process (Mertler, 2017). The final step again was to represent the findings (Creswell & Poth, 2018; Mertler, 2017). Again, as before, themes were authenticated in order to align to the research questions (Stuckey, 2015).

**Student Observations**

When analyzing the data, the aim was, through as much as possible, the words of the participants themselves, to synthesize what was observed and recorded during the
observations. Highlighted by Constable et al. (2012) was the importance of the observer to apply critical techniques to the coding process without overreaching what was written in the notes, ensuring that events are not selected out of context that may misrepresent any given situation. Through careful investigation, thematic and content analyses offered conclusions to be drawn from the data. The analysis revealed common language, themes, group dynamics, or culture, as well as represented group dynamics which were then coded. Once coding had occurred, the next step was to refine the process and use descriptive coding as part of the process of inductive analysis (Belotto, 2018; Saldaña, 2009). Similar to the coding and analysis of the interview process previously stated, these codes were further reduced to common categories and themes using emergent coding process (Mertler, 2017). Emerging themes were authenticated in order to align them to the research questions (Stuckey, 2015).

**Quantitative Data Analysis**

The quantitative data was analyzed by comparing the MSLQ and CAPL-2 pre- and post-intervention questionnaires data in order to measure the change in participant’s motivation for learning towards PL over the course of the curriculum unit. A paired samples t-test determined the impact that the intervention had overall on the motivation of students towards learning PL as there was a pre- and post-intervention questionnaires comparing the means of two variables for the same group of 31 students (Creswell & Creswell, 2018; Holland et al., n.d.; Li et al., 2020; Meijs et al., 2019; Pintrich, 2003; Pintrich et al., 1991; Soemantri et al., 2018). The Bonferroni adjustment was used in order to adjust the p-values and determine if there were any significant differences in the treatment means and avoid the chance of a false significance in the analysis of the data.
The results of the Bonferroni adjustment for the MSLQ was <0.01. While the result for the CAPL-2 was 0.01.

**Procedures and Timeline**

The procedures conducted in this mixed-methods study fell under five phases. Each phase occurred in a specific order. Phases 1 through 4 occurred during the intervention and data collection period, while the data analysis from Phase 5 took place after the intervention during the analysis stage of the process. These phases were outlined in Table 3.7 below.

**Table 3.7**

*Timeline of Data Collection Procedures*

<table>
<thead>
<tr>
<th>Phase</th>
<th>Expectation</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Consent and Assent forms to be completed</td>
<td>One week</td>
</tr>
<tr>
<td></td>
<td>Schedule outlined</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>Completion of MSLQ and CAPL-2 pre-intervention questionnaires</td>
<td>One week</td>
</tr>
<tr>
<td></td>
<td>Procedural explanation of student journal obligations</td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>Conduct student observations</td>
<td>Six weeks</td>
</tr>
<tr>
<td>Phase 4</td>
<td>Conduct post-intervention student interviews</td>
<td>Two weeks</td>
</tr>
<tr>
<td></td>
<td>Completion of the MSLQ and CAPL-2 post-intervention</td>
<td></td>
</tr>
<tr>
<td>Phase 5</td>
<td>Student interview transcription and coding</td>
<td>Four weeks</td>
</tr>
<tr>
<td></td>
<td>Student journal analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre and post questionnaires analysis</td>
<td></td>
</tr>
</tbody>
</table>

The first phase of the intervention was conducted in August of 2021. This phase took one week. During this phase, I informed students of the research taking place and after that, they determined if they would be part of the research or not. Once decided, I gave participants assent forms to be completed and submitted acknowledging that they would be a part of the study. (See Appendix B)
In phase two, the pre-intervention questionnaires (See Appendix A), were completed by participants. This phase was allotted one week to be completed and collected. The questionnaires were collected using Google Forms. The questionnaires were completed during a regularly scheduled class period lasting 75 minutes. Students were allowed extra time if needed. Participants accessed the Google Form through a link provided through their LMS, Power School Learning (PSL). During this phase, the explanation, expectations, and an outline of student journals occurred. Exemplars and a demonstration of how this would take shape occurred during the second period in the week. An explanatory video supported the face-to-face explanation on the LMS in order to ensure understanding. This process presented opportunities for students to clarify any questions that they may have had about their objectives, as well as outlined procedures and timelines for journal entries.

Phase three was conducted over the course of six weeks. During this phase, the intervention took place. Bi-weekly observations took place and detailed field notes were transcribed from an observer perspective. At this time, participants were writing in their prompted student reflections journals. These journals were completed using a Google Doc, which was shared with the researcher in order to offer easy access to read and evaluate each week throughout the intervention, as well as when the intervention is completed.

Phase four will consist of two key elements: (1) the post-intervention questionnaires and (2) the post-intervention student interviews. This phase was allocated two weeks in order to collect and complete the questionnaires and student interview components. The post-intervention questionnaires were conducted in the same way that
the pre-intervention questionnaires were, through the use of a Google Form, located on the class learning platform. (See Appendix B). As students had already taken the questionnaires and were familiar with procedures and protocols, less time was spent on the explanation.

For the participant interviews, a schedule was made providing blocks for semi-structured interviews to take place. As the interview process can be lengthy, the interviews were held to approximately 15-20 minutes, and audio recorded. (See Appendix D). Later the recordings were transcribed using F5 Transcription Pro and Google Docs. These interviews were audio recorded in order to analyze after the interviews were completed. Having the ability to record ensures that data can be collected and preserved (Mertler, 2017).

In the final phase, phase five, I took four weeks to transcribe, using F5 Transcription Pro, for the participant interviews that were recorded. Reading through the interview transcriptions multiple times facilitated the iterative process of in vivo coding. The coding method was utilized to analyze the interview transcripts and determine distinct themes through inductive analysis. During this phase, the coding of student journals also occurred using the same coding as the interview transcription set of codes. Similarly, to the transcription and coding of the participant interviews, this process identified and looked for common themes.

After collecting, transcribing, and coding all the raw qualitative data, analysis began in the proceeding semester (Summer semester) of course work. This allowed ample time to follow up and exhaustively analyze the data collected from the intervention. This time was a critical moment where the qualitative and quantitative data
results were compared using a convergent design method. Results from this determined the effectiveness of the intervention on student motivation.

**Rigor and Trustworthiness**

In research, rigor is often used synonymously or interchangeably with trustworthiness and validity (Hays et al., 2016). According to Kline (2008), rigor or trustworthiness can be described as the level into which evidence is presented and described through various ways to offer credibility to the methods of research in a qualitative study. The quality of research or rigor is dependent on several factors: the approach to design, analysis of the data, interpretation of the qualitative data, and the presentation of the results (Creswell, 2012). Rigor and trustworthiness in this research was demonstrated through several methods: thick, rich description; member checking; peer debriefing, and triangulation (Shenton, 2004; Creswell, 2012; Mertler, 2017; Creswell & Creswell, 2018; FitzPatrick, 2019).

**Thick, Rich Description**

In order to achieve thick, rich descriptions to give the reader as complete a picture as possible, data was varied as well as detailed. A narrative that describes the participants, the settings, and all of the details that go along with the study conveyed to the reader a perspective that goes beyond the thinness of descriptions offering only facts (Creswell & Creswell, 2018; FitzPatrick, 2019; Shenton, 2004). In order to address rich data, several sources were utilized, such as: observations, journals, and interviews. These offered the reader a full range of data sources in order to enrich and add to the picture of the intervention (FitzPatrick, 2019). Thick descriptions came from field notes that illustrate the setting and climate for the intervention environment, to add to the overall
perspective (Creswell & Creswell, 2018; FitzPatrick, 2019; Mertler, 2017). Audio recordings from interviews were utilized to capture the emotion and intonation in voices, aid in the transcription process, and helped with inferences throughout the interviews (FitzPatrick, 2019). Photos accompanied observation field notes to help align the setting with what was written. A colorful expression of images will help to reinforce what was observed.

**Member Checking**

Using member checking acted as a critical way to ensure that misinterpreting or misrepresenting the participants’ actions or words was avoided. This process, especially within the context of interviews, considerably impacted the data interpretations and findings if an action were to be taken out of context (FitzPatrick, 2019). In order to verify accuracy of findings from the interviews, participants reviewed and provided clarification on transcripts and notes to ensure that what they have said or their actions were not taken out of context or misinterpreted. This offers a deeper level of credibility to the research if the participants have read over transcripts and conferred that they agree with what has been said and captured (Shenton, 2004). In order to facilitate this, transcripts, findings, and interpretations was offered to the participants to read over and requested to offer feedback during meetings that occurred post-data collection and during the draft process once findings and theories had been formalized and determined from the findings (Hays & Singh, 2012; Hays et al., 2016). These findings may result in changes or amendments that in the end will add validity and credibility to the research. Member checks are one of the most critical components to create credibility and validation to any qualitative research (FitzPatrick, 2019; Guba & Lincoln, 1989; Shenton, 2004).
A post-intervention meeting was held with the participants from the study in order to present them with the research findings. Meetings occurred post-intervention to present the coded findings to these participants in order for them to see and understand the results from the research and therefore benefit from their involvement and pose questions if they have any (Belmont Report, 1978). This involved presenting the participants with the findings from the study through a half-hour-long PowerPoint presentation during a regularly scheduled class period. This PowerPoint presentation was an updated version of the research data that included possible amendments from feedback. Any questions the participants had were shared with the researcher via email or during a face-to-face scheduled time. This was scheduled within two weeks of the presentation and then addressed to the best of the researcher’s ability in a timely manner. Participants were provided with a questionnaire to fill out using Google Forms after the presentation. This helped focus the researcher in answering any questions.

**Peer Debriefing**

This was an opportunity to receive feedback from several contemporaries in order to decrease the potential of bias. “Discussion about the method and the analysis will bring the researcher back into the data and strengthen trustworthiness” (FitzPatrick, 2019, p. 214). In order to accomplish this, regularly scheduled sessions with the institution’s Curriculum Coordinator, were held. During this time, regularly scheduled meetings with my advisor took place where feedback and guidance were given. These meetings ensured that the validity of my conclusions and theories which were reflected upon (Creswell & Creswell, 2018; Mertler, 2017). All opportunities to engage with colleagues about the
process were met with the understanding that it will result in increased credibility and
validity of the research (Shenton, 2004).

**Triangulation**

In order to increase the credibility of my findings and ensure that bias is
minimized, multiple sources of data collection were utilized (FitzPatrick, 2019). These
various other data methods have already been tested and have their credibility proven
through rigorous processes and therefore add validity to the data sources triangulation
method (Creswell, 2012; Creswell & Creswell, 2018; FitzPatrick, 2019; Mertler, 2017;
Shenton, 2004). Interviews, observations, and pre- and post-intervention questionnaires
data methods ensured that any methodological shortcomings from one data source were
compensated by the use of other data collection methods resulting in richer data
providing more authenticity and credibility to ensure a higher degree of rigor and
trustworthiness (FitzPatrick, 2019; Shenton, 2004).

**Sharing and Communicating Findings**

The findings for this study were shared through different means in order to ensure
that there were clear protocols for participants to follow and that the study was conducted
in an ethical manner. “In its simplest definition, ethics are norms for conduct that
distinguish between acceptable and unacceptable behavior” (Clark, 2019, p. 394). The
initial stage of this process was to go through and explain the findings through the use of
a PowerPoint presentation to ASH’s Curriculum Director, Middle School Principal and
Assistant Principal. The purpose of presenting the research data and study’s findings was
to ensure that all steps and protocols followed school policy and guidelines. During this
presentation of the research, the members were shown how the intervention had followed
the plan outlined and the feedback was centered around the differences between the
quantitative and qualitative findings. This was an opportunity to identify that the quantitative findings centered around changes and transformations that are likely to need more time for efficacy to occur. Participants’ privacy was protected through the use of coding and removing identifiable information from the findings, ensuring confidentiality (Belmont Report, 1978). This was done within two weeks of the end of the research or at the earliest convenience of the administrative team members. Questionnaires and interview questions were formalized and shared via Google Forms prior to the presentation and clearly stated that their intention was to be used to address any other possible interpretations of the evidence that may not have been considered by the researcher. The process was completed over the course of an hour-long face-to-face meeting shortly after the PowerPoint presentation.

The final step, after presenting the findings to the participants, was presenting those same findings to staff on December 8th at a faculty meeting. They were presented with a redacted PowerPoint version of findings to protect the privacy of the participants (Belmont Report, 1978). This slide deck was presented at a scheduled staff meeting. A separate meeting with the curriculum director took place on the 10th in order to, according to Mertler (2017), explore in more depth the future role of this research in the context of the school curriculum moving forward.
CHAPTER 4

ANALYSIS AND FINDINGS

The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit in order to increase eighth-grade students’ PL knowledge at an international middle school. The research questions used to guide this study were: (1) How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy? (2) How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills? (3) What are eighth-grade students’ perceptions of how a technology blended, physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?

This chapter begins with the presentation and analysis of the quantitative data which consists of a pre- and post-intervention questionnaires, as well as an observation checklist. This is then proceeded by the qualitative data analysis of student journals, student observations and one-on-one interviews.

**Quantitative Analysis and Findings**

This study utilized two pre- and post-intervention questionnaires (see Appendix A) to measure the changes in motivation and PL amongst the 31 participants. The questionnaires were member checked with the other members of the middle school PE department to ensure that the questionnaires aligned with the research questions and
the aims of the intervention. In addition, an observation checklist (see Appendix E) was used as a quantitative data source to measure the frequency of specific behaviors. The observation checklist was applied during four separate periods during the intervention.

The pre- and post-intervention data sources included 1) the MSLQ, and 2) CAPL-2. For both the MSLQ and CAPL-2 pre- and post-intervention questionnaires, descriptive statistics and a paired sample *t*-tests were used to explore the impact of the intervention.

Measurements of the pre- and post-intervention questionnaires determined the mean difference between two variables with the intervention having occurred in between them. Along with this, descriptive statistics were employed to offer a representation of the data set in relation to a sample of the population (*n* = 31). On both the pre- and post-intervention questionnaires, inferential statistics were used and the Bonferroni correction was applied wherever there were multiple comparisons made.

In order to accomplish the analysis of the different data sources (MSLQ, CAPL-2 and observation checklist), Microsoft Excel served two purposes, one in creating comma-separated values (CSV) formatted data files for the pre- and post-intervention questionnaires that were utilized for readable data input in JASP. The second being the creation of frequency tables using excel formulas to construct them for the purposes of the observation checklist. This was done by transferring the data into several Excel spreadsheets, and importing them to JASP, ready for further statistical analysis.

**Demographics**

The available demographic information of the intervention participants is provided in Tables 4.1 and 4.2. The intervention participants consisted of 13 (42%) male and 18 (58%) female. Of the 31 participants, ethnicities were distributed as: 15 (48%)
European, 8 (26%) North American, 3 (10%) South Asian, 2 (6%) Asian, 2 (6%) South American and 1 (3%) African. In addition to these, all participants were given pseudonyms, were 13 years of age and in grade eight at the time of the intervention as seen in Table 4.3.

**Table 4.1**

*Frequency of Ethnicity Groupings*

<table>
<thead>
<tr>
<th>Ethnicity Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian (A)</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>African (AF)</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>European (E)</td>
<td>15</td>
<td>48</td>
</tr>
<tr>
<td>North American (NA)</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>South American (SAM)</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>South Asian (SAs)</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

**Table 4.2**

*Frequency of Gender Groupings*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>18</td>
<td>58</td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4.3
Focus Group Participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Ethnicity</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>South American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Angela</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Brad</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Barb</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Francis</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Gabriella</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Gerry</td>
<td>South Asian</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Hannah</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Kendrick</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Karl</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Nathan</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Peter</td>
<td>North American</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Rachel</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Sarah</td>
<td>South Asian</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Tanya</td>
<td>Asian</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Wilma</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Zac</td>
<td>Asian</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Bruno</td>
<td>South American</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Bob</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Danny</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Erin</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Fred</td>
<td>North American</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Freda</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Heather</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Kevin</td>
<td>European</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Pam</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Sandra</td>
<td>South Asian</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Sabha</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Vanessa</td>
<td>European</td>
<td>F</td>
<td>13</td>
</tr>
<tr>
<td>Vince</td>
<td>African</td>
<td>M</td>
<td>13</td>
</tr>
<tr>
<td>Winnie</td>
<td>North American</td>
<td>F</td>
<td>13</td>
</tr>
</tbody>
</table>

Note. F = female and M = male
Motivated Strategies for Learning Questionnaire

The MSLQ questionnaire functions through the lens of motivation and learning strategies based on a general cognitive view (Pintrich et al., 1991). The MSLQ is a self-reporting instrument used to determine the motivation of individuals toward various learning strategies within the context of a subject or course. This instrument is comprised of two domains, listing of motivation scales and listing of learning strategies scales. For this intervention, it was determined that only the listing of motivation scales domain was to be applied. This domain comprised of 31 items out of the total 81-item questionnaire. This was done because these were effective measures suitable for this intervention as they relate specifically to motivation towards goals, value beliefs, belief in one’s own abilities to succeed as well as test anxiety within the subject or course. The 31 items selected from the listing of motivation scales domain, are divided into three scales, these scales were: 1) Value components, 2) expectancy components, and 3) affective components. These three scales were further divided into six subscales. Under the value components scale: 1) Intrinsic goal orientation, 2) extrinsic goal orientation, and 3) task value. The expectancy components subscales were: 1) control beliefs, 2) and self-efficacy for learning and performance. The final scale of affective components consisted of the sub-scale test anxiety.

The reliability for the MSLQ scales for this study running the data using Cronbach’s alpha, were as follows: .81 for value components, .86 for expectancy components, and .74 for affective components. The reliability for the MSLQ subscales were as follows: .76 for intrinsic goal orientation, .77 for extrinsic goal orientation, .57
for task value, .67 for control of learning beliefs, .87 for self-efficacy for learning performance, and .74 for test anxiety.

**Value Components**

There are three subsections for value components, see Table 4.4 for the three subscales of intrinsic goal orientation, extrinsic goal orientation, and task value se items.

**Descriptive Statistics.** The descriptive statistics for the MSLQ value component subscales of the pre- and post-intervention subscales were recorded in Table 4.4. *Intrinsic goal orientation* had a pre-intervention mean of 5.11 (SD = 0.75), with a post-intervention mean of 4.98 (SD = 1.05), with a decrease in the mean score from pre- to post-intervention. *Extrinsic goal orientation* had a pre-intervention mean of 5.44 (SD = 1.26), with a post-intervention mean of 5.07 (SD = 1.13), with a decrease in the mean score from pre- to post-intervention. *Task value* had a pre-intervention mean of 5.18 (SD = 0.94), with a post-intervention mean of 4.74 (SD = 1.17), with a decrease in the mean score from pre- to post-intervention.

**Table 4.4**

<table>
<thead>
<tr>
<th>Subscales</th>
<th>$M_{pre}$</th>
<th>$SD_{pre}$</th>
<th>$M_{post}$</th>
<th>$SD_{post}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic goal orientation</td>
<td>5.11</td>
<td>.75</td>
<td>4.98</td>
<td>1.05</td>
</tr>
<tr>
<td>Extrinsic goal orientation</td>
<td>5.44</td>
<td>1.26</td>
<td>5.07</td>
<td>1.13</td>
</tr>
<tr>
<td>Task value</td>
<td>5.18</td>
<td>.94</td>
<td>4.74</td>
<td>1.17</td>
</tr>
<tr>
<td>Control of learning beliefs</td>
<td>5.37</td>
<td>.76</td>
<td>5.46</td>
<td>1.02</td>
</tr>
<tr>
<td>Self-efficacy for learning performance</td>
<td>5.65</td>
<td>.82</td>
<td>5.66</td>
<td>1.17</td>
</tr>
<tr>
<td>Test anxiety</td>
<td>4.19</td>
<td>1.31</td>
<td>4.53</td>
<td>1.18</td>
</tr>
</tbody>
</table>

**Inferential Statistics.** A paired samples $t$-test was used to determine the impact on motivation towards the PL of students as reported in Table 4.5 as well as the $t$, $df$ and $p$. To test the assumptions of normality, the Shapiro-Wilk normality test as well as skewness and kurtosis values were checked. The Shapiro-Wilk normality test was
significant, which showed the difference between the pre- and post-intervention test to be not normally distributed (Intrinsic goal orientation $p < .001$, extrinsic goal orientation $p = .047$ and task value $p = .007$). According to Pearson (1895), skewness and kurtosis are sometimes used as standards for normality as they are well established descriptive statistics for normality. The skewness and kurtosis were used in order to communicate the degree of nonnormality (Field et al., 2012; Ho & Yu, 2015). These values ranged between -2 and +2 in each subscale which indicated that there was a leftward skew and moderately heavier tails compared to a normal distribution. The paired samples $t$-test revealed that there was no significant difference between the pre- and post-intervention questionnaires scores with $t(30) = 0.89, p = .38$ for intrinsic goal orientation, $t(30) = 2.03, p = .05$ for extrinsic goal orientation, and $t(30) = 2.10, p = .04$ for task value. This was used in order to determine the test constancy over time and ensure the stability as there was a pre- and post-intervention questionnaire (Naibert et al., 2021; Salkind, 2010; Shavelson, & Steedle, 2010). Using the Bonferroni adjustment for these subscales we have a value of 0.41 and based on the data and the correction applied using $0.05/3 = 0.17$, there was not strong evidence to conclude a statistically significant result.

<table>
<thead>
<tr>
<th>Table 4.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Results from the Paired Samples $t$-Test</td>
</tr>
<tr>
<td>Subscales</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Intrinsic goal orientation</td>
</tr>
<tr>
<td>Extrinsic goal orientation</td>
</tr>
<tr>
<td>Task value</td>
</tr>
<tr>
<td>Control of learning beliefs</td>
</tr>
<tr>
<td>Self-efficacy for learning performance</td>
</tr>
<tr>
<td>Test anxiety</td>
</tr>
</tbody>
</table>
**Expectancy Components**

The expectancy components subscales were: Control of learning beliefs, and self-efficacy for learning and performance.

**Descriptive Statistics.** The descriptive statistics for the MSLQ expectancy component subscales of the pre- and post-intervention subscales were recorded in Table 4.4. Control of learning beliefs had a pre-intervention mean of 5.37 (SD = 0.76) and a post-intervention mean of 5.46 (SD = 1.02) with an increase in the mean score from pre- to post-intervention. Self-efficacy for learning had a pre-intervention mean of 5.65 (SD = 0.82), with a post-intervention of 5.66 (SD = 1.17) with an increase in the mean score from pre- to post-intervention.

**Inferential Statistics.** A paired samples t-test was used to determine the impact on motivation towards the PL of students as reported in Table 4.5 as well as the t, df and p. To test the assumptions of normality, the Shapiro-Wilk normality test as well as skewness and kurtosis values were checked. The Shapiro-Wilk normality test was not significant, which showed the difference between the pre- and post-intervention test to be normally distributed (control of learning beliefs p < .69, and self-efficacy for learning p < .87). According to Pearson (1895), skewness and kurtosis are sometimes used as standards for normality as they are well established descriptive statistics for normality. The skewness and kurtosis were used in order to communicate the degree of nonnormality (Field et al., 2012; Ho & Yu, 2015). These values ranged between -1 and +1 in each subscale. This suggested that the data distributions were close to normal. The paired samples t-test revealed that there was no significant difference between the pre- and post-intervention questionnaires scores with, t(30) = 0.55, p = .58 for control of
learning beliefs, and $t(30) = 0.96, p = .92$ for self-efficacy for learning. This was used in order to determine the test constancy over time and ensure the stability as there was a pre- and post-intervention questionnaire (Naibert et al., 2021; Salkind, 2010; Shavelson, & Steedle, 2010). Using the Bonferroni adjustment for these subscales we have a value of 0.43 and based on the data and the correction applied using $0.05/2 = 0.25$, the evidence was not strong enough to conclude a statistically significant result.

Affective Components

The subscale for the affective components was test anxiety. This is the only scale that was negatively related within the 31-item MSLQ.

Descriptive Statistics. The descriptive statistics for the MSLQ affective component subscales of the pre- and post-intervention subscales were recorded in Table 4.4. Test anxiety had a pre-intervention mean of 4.19 ($SD = 1.31$), with a post-intervention mean of 4.53 ($SD = 1.18$) with an increase in the mean score from pre- to post-intervention.

Inferential Statistics. A paired samples $t$-test was used to determine the impact on motivation towards the PL of students as reported in Table 4.5 as well as the $t$, $df$, and $p$. To test the assumptions of normality, the Shapiro-Wilk normality test as well as skewness and kurtosis values were checked. The Shapiro-Wilk normality test was not significant, which showed the difference between the pre- and post-intervention test to be normally distributed (test anxiety $p < .67$). According to Pearson (1895), skewness and kurtosis are sometimes used as standards for normality as they are well established descriptive statistics for normality. The skewness and kurtosis were used in order to communicate the degree of nonnormality (Field et al., 2012; Ho & Yu, 2015). These
values ranged between -2 and +2 in each subscale. The paired samples $t$-test revealed that there was no significant difference between the pre- and post-intervention questionnaires scores with $t(30) = 1.65, p = .11$ for test anxiety. This was used in order to determine the test constancy over time and ensure the stability as there was a pre- and post-intervention questionnaire (Naibert et al., 2021; Salkind, 2010; Shavelson & Steedle, 2010).

**Canadian Assessment of Learning Second Edition Questionnaire**

The CAPL-2 is a comprehensive survey that accurately and reliably assesses the PL levels of the individual participants being measured (Longmuir, 2013). Two parts of the CAPL-2 questionnaire were utilized for the intervention: Knowledge and understanding, which was to assess the PL of participants, as well as the motivation and confidence domain used to assess the participant’s confidence in their ability to be physically active. These two domains were used to measure the changes in PL from pre-to post-intervention of this specific unit. There were two domains: Knowledge and understanding domain, and the motivation and confidence domain. The motivation and confidence domain was broken into four subscales: 1) *Predilection*, 2) *adequacy*, 3) *intrinsic motivation* and 4) physical activity *confidence*.

The reliability for the CAPL-2 scales for this study running the data using Cronbach’s alpha, were as follows: .77 for knowledge and understanding, and .93 for motivation and confidence. The subscales for the motivation and confidence scale were: .69 for predilection, .85 for adequacy, .74 for intrinsic motivation, and .85 for physical activity confidence. With these scores, it is evident that the items selected for the pre- and post-intervention questionnaire have high to very high levels of internal consistency for the sample scales and subscales (Bonnet, 2008; Bonnet & Wright, 2015).
**Knowledge and understanding.** The knowledge and understanding domain scores were based upon the summed score of a maximum of 10 points based on five questions. The total was based on a score from one to a maximum of 10 points as seen in Appendix G.

In order to interpret the domain score, four categories were assigned based on more than 10,000 participants from ages eight to twelve (Sport for Life, 2020; Tremblay et al., 2018). These categories are: 1) beginning, 2) progressing, 3) achieving, and finally 4) excelling. As students in this intervention had mostly just turned 13 years of age at the time of the intervention, scores were interpreted based on the highest range offered in the assessment of 12 years of age as seen in Appendix G show the scoring for the various domains of the CAPL-2 questionnaire as labeled.

**Descriptive Statistics.** The descriptive statistics for the CAPL-2 knowledge and understanding domain for the pre- and post-intervention were recorded in Table 4.6. The pre-intervention mean score was 8.32 ($SD = 1.89$) for knowledge and understanding, while the post-intervention mean scores was 8.55 ($SD = 1.57$). The domain score increased slightly from pre- to post-intervention questionnaire.

**Table 4.6 Descriptive Statistics for Knowledge and Understanding, and Motivation and Confidence Domain Subscales.**

<table>
<thead>
<tr>
<th>Domain</th>
<th>$M_{pre}$</th>
<th>$SD_{pre}$</th>
<th>$M_{post}$</th>
<th>$SD_{post}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and understanding</td>
<td>8.32</td>
<td>1.89</td>
<td>8.55</td>
<td>1.57</td>
</tr>
<tr>
<td>Motivation and confidence subscales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predilection</td>
<td>6.44</td>
<td>1.42</td>
<td>6.63</td>
<td>1.16</td>
</tr>
<tr>
<td>Adequacy</td>
<td>6.38</td>
<td>1.44</td>
<td>6.55</td>
<td>1.17</td>
</tr>
<tr>
<td>Intrinsic motivation</td>
<td>6.47</td>
<td>1.16</td>
<td>6.63</td>
<td>1.01</td>
</tr>
<tr>
<td>Physical activity confidence</td>
<td>5.84</td>
<td>1.40</td>
<td>5.94</td>
<td>1.10</td>
</tr>
</tbody>
</table>
**Inferential Statistics.** A paired-samples $t$-test was used to determine if there was a statistically significant effect on PL students achieved, as reported in Table 4.7. To test the assumptions of normality, the Shapiro-Wilk normality test as well as skewness and kurtosis values were checked. The Shapiro-Wilk normality test was not significant, which showed the difference between the pre- and post-intervention test to be normally distributed (knowledge and understanding $p < .001$). These results suggested a rejection of the null-hypothesis with a significant deviation from normality (Field et al., 2012). The skewness and kurtosis values ranged from -2 and +2. The skewness demonstrating that the distribution is skewed to the left and the majority of the data concentrated on the right side. The kurtosis value indicates that the distribution has a leptokurtic shape compared to a normal distribution (Field et al., 2012). The paired-samples $t$-test revealed there is not a significant difference between the participants’ pre-intervention scores ($M = 8.32, SD = 1.89$) and post-intervention scores ($M = 8.55, SD = 1.57$), $t (30) = 0.84, p = .41$, despite the skewness and kurtosis values in the data.

**Motivation and confidence.** This domain consisted of four subscales each given its own points system and assigned a total that was summed to obtain the total score.

**Descriptive Statistics.** The descriptive statistics for the CAPL-2 motivation and confidence domain of the pre- and post-intervention subscales were recorded in Table 4.7 with a maximum score of 7.5 points for each subscale. The pre-intervention mean for each subscale was: 6.44 for predilection ($SD = 1.42$), 6.38 for adequacy ($SD = 1.16$), 6.47 for intrinsic motivation ($SD = 1.16$), and 5.84 for physical activity confidence ($SD = 1.40$). While the post-intervention mean scores were: 6.63 for predilection ($SD = 1.16$), 6.55 for adequacy ($SD = 1.17$), 6.63 for intrinsic motivation ($SD = 1.01$), and 5.94 for
physical activity confidence ($SD = 1.10$). All scales increased slightly from pre- to post-intervention questionnaire.

**Table 4.7 Reporting Results from the Paired Samples t-Test**

<table>
<thead>
<tr>
<th>Domain</th>
<th>$t$</th>
<th>df</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and understanding</td>
<td>0.84</td>
<td>30</td>
<td>.41</td>
</tr>
<tr>
<td>Motivation and confidence subscales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predilection</td>
<td>0.84</td>
<td>30</td>
<td>.41</td>
</tr>
<tr>
<td>Adequacy</td>
<td>1.05</td>
<td>30</td>
<td>.30</td>
</tr>
<tr>
<td>Intrinsic motivation</td>
<td>0.90</td>
<td>30</td>
<td>.37</td>
</tr>
<tr>
<td>Physical activity confidence</td>
<td>0.59</td>
<td>30</td>
<td>.56</td>
</tr>
</tbody>
</table>

**Inferential Statistics.** A paired-sample $t$-test was used to determine the level of PL students achieved as reported in Table 4.7. To test the assumptions of normality, the Shapiro-Wilk normality test as well as skewness and kurtosis values were checked. The Shapiro-Wilk normality test detected that these four subscales deviate from normality in varying degrees. Predilection ($p = .025$) based on the test provides evidence that the subscale deviates from a normal distribution and is not normally distributed. Adequacy ($p < .001$) is less than 0.001 which is highly significant. This indicated strong evidence for a deviation from a normal distribution. The extremely low p-value suggests a substantial departure from normality. Intrinsic motivation ($p = .001$) indicated, similarly to predilection, that the subscale also deviated from a normal distribution. Finally, physical activity confidence ($p = .051$) although having a p-value greater than 0.05 is still relatively close to it and offers that there is some evidence to suggest that the data for physical activity confidence may deviate from a normal distribution, but is not as strongly supported as the other three subscales (Field et al., 2012). The skewness and kurtosis values ranged from -2 and +1 in each subscale. The skewness demonstrating that the distribution is skewed to the left and the majority of the data concentrated on the right
side. The kurtosis value indicates that the distribution has slightly heavier tails than a normal distribution. The paired samples $t$-test revealed that there was no significant difference between the pre- and post-intervention questionnaires scores with $t(30) = 0.84$, $p = .41$ for predilection, $t(30) = 1.05$, $p = .30$ for adequacy, $t(30) = 0.90$, $p = .37$ for intrinsic motivation and $t(30) = 0.59$, $p = .56$ for physical activity confidence. These were the following results after applying the Bonferroni adjustment for the subscales:

Predilection value of 0.025 is higher than the Bonferroni adjusted alpha of 0.013 which made this not statistically significant. Adequacy value of $< 0.001$ was lower than the Bonferroni adjusted alpha of 0.013 and therefore is considered statistically significant. Intrinsic motivation value of 0.001 was lower than the Bonferroni adjusted alpha of 0.013 and therefore is considered statistically significant. Finally, physical activity confidence value of 0.051 is higher than the Bonferroni adjusted alpha of 0.013 which made this not statistically significant.

**Observation Checklist Frequency**

The observation checklist based upon an interpretation of Haerens’ (2013) List of Observed Need-Supportive Teaching Behaviors model, consisting of 21 items, was designed to record observational data from four different structured observations. The instrument used specific criteria based on research question three, in order to determine engagement and interactions throughout the intervention done by the teacher-researcher as an observer (Mertler, 2017). The data collected was done during the course of four separate observations, while students were creating their projects in class. The observation dates were: October 8th for the first observation; October 28th for the second observation; November 1st for the third observation, and November 23rd for the fourth
and final observation. Each observation was broken into three 15-minute periods: 0-15 minutes, 15-30 minutes and 30-45 minutes. During each of these periods, a 21-item checklist was observed and the frequency of students meeting the specific parameters of each task was tabulated. The data taken from each observation was then put into frequency tables in MS Excel and saved as a CSV file and then opened in JASP for further analysis. In JASP descriptive statistics were used in order to determine the standard deviation and the mean of the data collected.

During the four observation periods each of the 21 items on the checklist were observed during three 15-minute periods. Each student that engaged in the various items on the observation checklist (Appendix E) were recorded. Table 4.8 outlines the number of students per item during the course of each 15-minute segment from the four different observation periods. This table demonstrates the number of students at any given time, engaged in behaviors represented on the checklist.
Table 4.8
Frequency Per Item for All Observational Periods During Observations

<table>
<thead>
<tr>
<th>Items</th>
<th>1st Observation</th>
<th>2nd Observation</th>
<th>3rd Observation</th>
<th>4th Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Questions</td>
<td>14</td>
<td>16</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>2 Choice</td>
<td>11</td>
<td>9</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>3 Experience</td>
<td>10</td>
<td>15</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>4 Explanation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>5 Overview</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>6 Descriptions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7 Collaborative</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 Variation</td>
<td>2</td>
<td>18</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>9 Differentiation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>10 Advice</td>
<td>7</td>
<td>4</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>11 Feedback</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>12 Encouragement</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>13 Role model</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>14 Helpful</td>
<td>7</td>
<td>12</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>15 Respectful</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>16 Present</td>
<td>27</td>
<td>30</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>17 Enthusiasm</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>18 Engagement</td>
<td>22</td>
<td>24</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>19 Perspective</td>
<td>0</td>
<td>15</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>20 Attention</td>
<td>0</td>
<td>13</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>21 Modelling</td>
<td>0</td>
<td>4</td>
<td>7</td>
<td>29</td>
</tr>
</tbody>
</table>

Note. Numbers under the observation times correspond with number of students meeting these criteria during the observation period.
For the first 15 minutes in each observation, students are being recorded at higher frequencies in the second and third observations per item than the first and in most cases the fourth. This is better depicted in Figure 4.1 where each observation’s items checklist are represented by different colors, as noted on the chart. Exceptions to this can be found in items 3, 4, 5, 6, 10, 11, 19, 20 and 21. In the case of the fourth observation, it should be noted that this was when projects were presented, therefore students were divided as evenly as possible across the 45-minute observation period, which in-turn affected the frequencies when measured against the other three observations (Table 4.9).
Table 4.9
Frequency Per Item for First 15 Minutes During Four Observations

<table>
<thead>
<tr>
<th>Items</th>
<th>1st Obs</th>
<th>%</th>
<th>2nd Obs</th>
<th>%</th>
<th>3rd Obs</th>
<th>%</th>
<th>4th Obs</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Questions</td>
<td>14</td>
<td>45</td>
<td>24</td>
<td>77</td>
<td>22</td>
<td>71</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>2 Choice</td>
<td>11</td>
<td>35</td>
<td>14</td>
<td>45</td>
<td>8</td>
<td>26</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>3 Experience</td>
<td>10</td>
<td>32</td>
<td>2</td>
<td>6</td>
<td>17</td>
<td>55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4 Explanation</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>16</td>
<td>20</td>
<td>65</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>5 Overview</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>84</td>
<td>9</td>
<td>29</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>6 Descriptions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>7 Collaborative</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>16</td>
<td>29</td>
<td>94</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 Variation</td>
<td>2</td>
<td>6</td>
<td>21</td>
<td>68</td>
<td>22</td>
<td>71</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>9 Differentiation</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>13</td>
<td>42</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>10 Advice</td>
<td>7</td>
<td>23</td>
<td>9</td>
<td>29</td>
<td>21</td>
<td>68</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>11 Feedback</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>61</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>12 Encouragement</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13 Role model</td>
<td>5</td>
<td>16</td>
<td>13</td>
<td>42</td>
<td>20</td>
<td>65</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>14 Helpful</td>
<td>7</td>
<td>23</td>
<td>19</td>
<td>61</td>
<td>11</td>
<td>35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15 Respectful</td>
<td>31</td>
<td>100</td>
<td>31</td>
<td>100</td>
<td>31</td>
<td>100</td>
<td>11</td>
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<td>100</td>
<td>31</td>
<td>100</td>
<td>31</td>
<td>100</td>
</tr>
<tr>
<td>17 Enthusiasm</td>
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<td>81</td>
<td>26</td>
<td>84</td>
<td>28</td>
<td>90</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>18 Engagement</td>
<td>22</td>
<td>71</td>
<td>29</td>
<td>94</td>
<td>30</td>
<td>97</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>19 Perspective</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>39</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>20 Attention</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>23</td>
<td>21</td>
<td>68</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>21 Modelling</td>
<td>0</td>
<td>0</td>
<td>29</td>
<td>94</td>
<td>4</td>
<td>13</td>
<td>11</td>
<td>35</td>
</tr>
</tbody>
</table>

Note. Observation is abbreviated to “Obs”.
Figure 4.1
Number of Students in the First 15 Minutes of Each Observation
The descriptive statistics for the observation checklist for the first 15 minutes of each of the four observations periods are recorded in Table 4.10. The standard deviation for the first 15 minutes from each observation was: First observation had a mean of 8, with a standard deviation of 10.27; the second observation had a mean of 15, with a standard deviation of 11.34; the third observation had a mean of 8, with a standard deviation of 9.58; the final observation had a mean of 9, with a standard deviation of 6.63. These frequencies were recorded and collected from the first 15-minute period of each observation of the four observation periods. The mean and standard deviation were recorded from the total number of students for each item on the checklist.

**Table 4.10**

*Descriptive Statistics for the First 15 Minutes of all Four Observations*

<table>
<thead>
<tr>
<th>0-15 minutes</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Observation</td>
<td>8</td>
<td>10.27</td>
</tr>
<tr>
<td>2nd Observation</td>
<td>15</td>
<td>11.34</td>
</tr>
<tr>
<td>3rd Observation</td>
<td>18</td>
<td>9.58</td>
</tr>
<tr>
<td>4th Observation</td>
<td>9</td>
<td>6.63</td>
</tr>
</tbody>
</table>

For the second 15 minutes of all four observational periods, we can see the frequency of the number and percentage of students that were engaged in each item of the checklist during the observation period (Table 4.11). For the second 15 minutes in each observation, students are being recorded at higher frequencies in the second and third observations per item, than the first and in most cases the fourth. This is better depicted in Figure 4.2 where each observation’s items checklists are represented by a different color. We can see the differences more clearly. Exceptions to this are in the various items of: 1) Questions, 2) choice, 5) overview, 6) descriptions, 9) differentiation, 11) feedback, 12) encouragement, and 14) helpful. In the case of the fourth observation, it should be noted that this was when projects were presented, therefore students were divided as evenly as
possible across the 45-minute observation period which affected the frequencies when measured against the other three observations. The outcome of this was that the second and third observations had a much higher mean than those of the first and last observations. This was likely due to the nature of the lesson. The first lesson was spent researching and determining what the course of action each participant would take, while the second and third observations were when participants were in the middle of creating their programs. The final observation was presentations and therefore was inherently likely to be lower in frequency.

Table 4.11

<table>
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<tr>
<th>Items</th>
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<th>2nd Obs</th>
<th>%</th>
<th>3rd Obs</th>
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<td>87</td>
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<td>22</td>
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<td>10</td>
<td>32</td>
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</tbody>
</table>

Note. Observation is abbreviated to “Obs”.

112
Figure 4.2 Number of Students in the Second 15 Minutes of Each Observation
The descriptive statistics for the observation checklist for the second 15 minutes of all four observations can be seen in Table 4.12. The standard deviation for the first 15 minutes from each observation was: First observation has a mean of 11, with a standard deviation of 10.36; the second observation had a mean of 17, with a standard deviation of 10.35; the third observation had a mean of 22, with a standard deviation of 8.55; and the final observation had a mean of 9, with a standard deviation of 6.51. These frequencies were taken from the checklist of the second 15-minute observation period for each of the four observations.

<table>
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<tr>
<th>15-30 minutes</th>
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<td>10.35</td>
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<tr>
<td>3rd Observation</td>
<td>22</td>
<td>8.55</td>
</tr>
<tr>
<td>4th Observation</td>
<td>9</td>
<td>6.51</td>
</tr>
</tbody>
</table>

For the final 15 minutes of all four observational periods, we can see the frequency of the number and percentage of students that were engaged in each item of the checklist during the observation period (Table 4.13). For the final 15 minutes in each observation, students are being recorded at higher frequencies in the second and third observations per item than the first and in most cases the fourth. This is better depicted in figure 4.3 where each observation’s items checklists are represented by a different color. We can see the differences more clearly. Exceptions to this are in the following items: 4) Explanation, 5) overview, 6) descriptions, 9) differentiation, 11) feedback, 13) role model, 17) enthusiasm, and 20) attention. In the case of the fourth observation, it should be noted that this was when projects were presented, therefore students were divided as evenly as possible across the 45-minute observation period which affected the
frequencies when measured against the other three observations similarly to the initial first 15-minute period of observation.

The second 15-minute period of the four observations held a similar pattern as the first 15-minute period, in that the second and third observations were considerably higher in frequency and analogously this was due to the type of lesson that took place in during these two observations.
<table>
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<th>%</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Obs</th>
<th>%</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Obs</th>
<th>%</th>
<th>4&lt;sup&gt;th&lt;/sup&gt; Obs</th>
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<tr>
<td>3 Experience</td>
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<td>0</td>
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<td>32</td>
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<tr>
<td>5 Overview</td>
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<td>10 Advice</td>
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<tr>
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<tr>
<td>18 Engagement</td>
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<td>74</td>
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<td>77</td>
<td>10</td>
<td>32</td>
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</tbody>
</table>
The descriptive statistics for the observation checklist for the final 15 minutes of all four observations can be seen in Table 4.14. The standard deviation for the final 15
minutes from each observation was: First observation had a mean of 11, with a standard deviation of 9.66; the second observation had a mean of 15; with a standard deviation of 9.38; the third observation had a mean of 18, with a standard deviation of 9.87, and the final observation had a mean of 9, with a standard deviation of 6.65. These frequencies were taken from the checklist in the final 15 minutes of each of the four observations. Here we see the trend continue where the first and last observations respectively have a lower mean than the second and third observations. Once again, this is likely due to the nature of the lessons being more research focused and in the middle of the process of putting the various elements of each individual’s project together.

Table 4.14
Descriptive Statistics for the Last 15 Minutes of all Four Observations

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<tr>
<td>4th Observation</td>
<td>9</td>
<td>6.65</td>
</tr>
</tbody>
</table>

Qualitative Analysis, Findings and Interpretations

Three different types of qualitative data sources from 31 participants were used: 1) three different journal prompt responses, 2) four separate participant observations, and 3) one-on-one post-intervention interviews with five participants. Journal prompt responses were given to participants in order to complete in weeks two, four and six. This was done in order to provide time for students to reflect on two-week’s worth of efforts towards the project with the dissemination of two FCM lessons to process and clarify. The summary of the data sources and number of emerged codes are described in Table 4.15. Data were mainly collected through the use of Google suite, but not limited to this. These included the use of Google forms for the student journal prompt responses, and
Google sheets for the input of the journal responses from Google forms. The observation checklist and field notes were also recorded using a Google doc. The use of Google docs for transcribing the Android audio app recorded one-on-one interviews. All the qualitative data were analyzed using Delve tool, an online qualitative data analysis tool, through several coding phases. The topics discussed in the following section are: 1) qualitative data analysis and 2) qualitative themes.

Table 4.15
Summary of Qualitative Data Sources

<table>
<thead>
<tr>
<th>Types of Qualitative Data Sources</th>
<th>Quantity of Data Collected</th>
<th>Number of Codes Taken from Data</th>
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</thead>
<tbody>
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<td>31</td>
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<tr>
<td>Journal response 1</td>
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<tr>
<td>Journal response 2</td>
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<td>14</td>
</tr>
<tr>
<td>Journal response 3</td>
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<td>18</td>
</tr>
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<td>Student observation periods</td>
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<td>29</td>
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<tr>
<td>One-on-one interviews</td>
<td>5</td>
<td>44</td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>78</strong></td>
<td><strong>62</strong></td>
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</table>

*Note. All student journal responses have some shared codes*

**Qualitative Data Analysis**

Due to the novel nature of this study, there were no preexisting codes going into the intervention, therefore inductive analysis was the method used to analyze the data from all three data sources (Miles et al., 2020; Saldaña, 2021). Inductive analysis involved three basic steps: 1) Organization, 2) description and 3) interpretation of each of the data sources (Glaser & Strauss, 1967; Saldaña, 2021). Firstly, the one-on-one interview transcripts were transcribed verbatim onto a Google Doc. The Observations and field notes from the observations were recorded on two separate Google docs. The
journal prompt responses were moved from a Google sheet to a Google doc. After
Google docs were created, all three data sources were uploaded into the Delve tool to
continue the analysis process.

The data collected from all three data sources were analyzed in the same way.
First, each source was read through in order to first get a sense of what was being
described by participants or viewed and recorded during the observations. Next, I went
through the field journal, student journals and interview responses sentence-by-sentence.
Using this sentence-by-sentence method enabled me to extract as much as possible from
the data sets and dig deeper into their possible meanings (Charmaz, 2014). In this
process, several methods were used in each of the coding cycles. As the data was already
broken into specific entries, I began with the first cycle of coding. The three types of
coding utilized in this first cycle process were: 1) Initial coding, 2) in vivo coding, and 3)
descriptive coding. A total of 62 codes were generated in the first cycle of coding as seen
in Figure 4.8.

*First cycle of coding.* During this first cycle, I began with initial coding to
analyze the three data sources. This was done in order to remain open to various
theoretical directions that the data may take during analysis (Charmaz, 2014; Saldaña,
2021). These codes demonstrated the initial impact of the intervention and helped to
guide the coding process. They would later be refined in the proceeding cycles of coding.
Some of these codes were, *technology offers easier access to more resources* or
*personalization of a program increases engagement and interest.* In both cases, these
were two codes that were identified during the process that helped in understanding
different facets of the intervention and more specifically, the research question.
After having gone through initial coding, I began in vivo coding, using the words of the students to continue process (Saldaña, 2021). These codes included terms taken from student language such as, “questioning” and “clarification”, “understanding” and “project applications”. In vivo coding was applied in the first round in order to use some of the words and phrases of the participants experiences in order to offer more authenticity in the coding process (Saldaña, 2021). Although a longer quote when Peter responded in the interview to a question about understanding his PL, “try and put it into practice, I guess. Do what I planned. Do what I set out, I guess. So, yeah, just do whatever, put what I've learned into practice and like fully understand it to the way of learning”, not only did it offer insight into his thinking, this became coded as put into practice what has been learned.

After in vivo coding was completed, descriptive coding was applied to identify topics within the three data sources (Tesch, 1990). Descriptive coding was utilized in order to summarize the content collected from the participant responses and the initial round of coding after initial coding was completed. As codes formed, they were refined either by combining them, eliminating them if they were a singleton, or placed into broader categories. This refining process enabled a higher-level look at the responses. One such example was Erin stating in her journal response one, “It has become more clear to me, the main focus of the project, what we hope to see from our projects TFP”, which was coded as FCM offers clear directions and aims of the project, due to the acknowledgement of the flipped classroom design and how it allowed for the participant to be focused and prepared when coming to class as well as to understand the expectations. Another code assigned during this process was, holistic understanding of
the project, which was drawn out from Pam who felt that, “The steps that I took in order to determine my focus for my fitness program included making a mental list of active activities that I do (and enjoy)”. This signified the broader context and outlook of the project design, although somewhat specific in reference. The journal prompts provided a student perspective to the project and how they viewed and interpreted the experience. The results from the first round of coding are shown in Figure 4.8. In total, the first cycle of coding identified 62 codes through the three rounds of coding.

**Second cycle of coding.** Continuing on in the process, the second cycle of this process applied two types of coding methods: 1) Focused coding, and 2) pattern coding. These further refined the initial categories from the first cycle of coding. This helped offer a better understanding of my data sets for the second cycle of coding (Saldaña, 2021).

After having identified 62 different codes in the first cycle, focused coding begins the process of identifying higher level codes and starts shifting towards categories. During this coding, more significant or frequent codes were used to formulate categories through combining similar codes from the first cycle of coding as seen in Figure 4.9. Two of these codes, 1) understanding of application of knowledge, and 2) holistic understanding of the project, into one category including both parts termed, understanding the full scope of the project.
Figure 4.4
Codes Generated in 1st Cycle of Coding

<table>
<thead>
<tr>
<th>Order of Code in List</th>
<th>Nested Level</th>
<th>Code Name</th>
<th>Number of Snippets</th>
</tr>
</thead>
<tbody>
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<td>1 &gt;</td>
<td></td>
<td>Project parameters and clear expectations offer more meaningful learning</td>
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</tr>
<tr>
<td>2 &gt;&gt;</td>
<td></td>
<td>FCM benefits to learning and understanding</td>
<td>0</td>
</tr>
<tr>
<td>3 &gt;&gt;&gt;</td>
<td></td>
<td>FCM offers clear directions and aims of the project</td>
<td>31</td>
</tr>
<tr>
<td>4 &gt;&gt;&gt;</td>
<td></td>
<td>FCM helps students with organization</td>
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</tr>
<tr>
<td>5 &gt;&gt;&gt;</td>
<td></td>
<td>FCM increases accountability with frequent and student-specific checkins</td>
<td>2</td>
</tr>
<tr>
<td>6 &gt;&gt;&gt;</td>
<td></td>
<td>FCM enabled more differentiation in learning, understanding and instruction</td>
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</tr>
<tr>
<td>7 &gt;&gt;&gt;</td>
<td></td>
<td>FCM structure encourages questioning and clarification</td>
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</tr>
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<td>8 &gt;&gt;</td>
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<td>Efficiency’s role in learning and understanding</td>
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<td>9 &gt;&gt;&gt;</td>
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<td>10 &gt;&gt;</td>
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<td>0</td>
</tr>
<tr>
<td>11 &gt;&gt;&gt;</td>
<td></td>
<td>Project helped focus and do more-in-depth examination</td>
<td>14</td>
</tr>
<tr>
<td>12 &gt;&gt;&gt;</td>
<td></td>
<td>The project increased motivation as interest grew</td>
<td>10</td>
</tr>
<tr>
<td>13 &gt;&gt;&gt;</td>
<td></td>
<td>Project increased understanding</td>
<td>14</td>
</tr>
<tr>
<td>14 &gt;&gt;</td>
<td></td>
<td>Clearly defined outcomes facilitate learning</td>
<td>0</td>
</tr>
<tr>
<td>15 &gt;&gt;&gt;</td>
<td></td>
<td>Project outcomes were clear</td>
<td>18</td>
</tr>
<tr>
<td>16 &gt;&gt;&gt;</td>
<td></td>
<td>Clearly defined steps to project with time to ask questions enabled progress</td>
<td>8</td>
</tr>
<tr>
<td>17 &gt;&gt;&gt;</td>
<td></td>
<td>Engagement grew with a deeper understanding of what the learning outcomes were</td>
<td>3</td>
</tr>
<tr>
<td>18 &gt;&gt;</td>
<td></td>
<td>Engaging in collaborative opportunities to increase efficacy and understanding</td>
<td>0</td>
</tr>
<tr>
<td>19 &gt;&gt;&gt;</td>
<td></td>
<td>Learning how to share and apply findings</td>
<td>5</td>
</tr>
<tr>
<td>20 &gt;&gt;&gt;</td>
<td></td>
<td>Peer feedback offering insight and understanding into the project</td>
<td>6</td>
</tr>
<tr>
<td>21 &gt;&gt;</td>
<td></td>
<td>Increasing levels of engagement</td>
<td>0</td>
</tr>
<tr>
<td>22 &gt;&gt;&gt;</td>
<td></td>
<td>Higher motivation increases engagement</td>
<td>4</td>
</tr>
<tr>
<td>23 &gt;&gt;&gt;</td>
<td></td>
<td>Enjoyment leads to engagement</td>
<td>7</td>
</tr>
<tr>
<td>24 &gt;&gt;</td>
<td></td>
<td>Understanding the full scope of the project</td>
<td>0</td>
</tr>
<tr>
<td>25 &gt;&gt;&gt;</td>
<td></td>
<td>Understanding of application of knowledge</td>
<td>3</td>
</tr>
<tr>
<td>26 &gt;&gt;&gt;</td>
<td></td>
<td>Holistic understanding of the project</td>
<td>25</td>
</tr>
<tr>
<td>27 &gt;</td>
<td></td>
<td>Motivation and engagement have not been affected through autonomy and learning</td>
<td>0</td>
</tr>
<tr>
<td>28 &gt;&gt;</td>
<td></td>
<td>There have been little to no noticeable changes in the intervention</td>
<td>0</td>
</tr>
<tr>
<td>29 &gt;&gt;&gt;</td>
<td></td>
<td>Higher understanding does not change outlook</td>
<td>1</td>
</tr>
<tr>
<td>30 &gt;&gt;&gt;</td>
<td></td>
<td>Transdisciplinary opportunities did not affect PL</td>
<td>4</td>
</tr>
<tr>
<td>31 &gt;&gt;</td>
<td></td>
<td>Motivation and Engagement were not really changed throughout</td>
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<tr>
<td>32 &gt;&gt;&gt;</td>
<td></td>
<td>Engagement was not affected, just remained the same</td>
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</tr>
<tr>
<td>33 &gt;&gt;&gt;</td>
<td></td>
<td>Motivation was not decreased from project</td>
<td>5</td>
</tr>
<tr>
<td>34 &gt;</td>
<td></td>
<td>Motivation is affected by connections and understanding of task(s)</td>
<td>0</td>
</tr>
<tr>
<td>35 &gt;&gt;</td>
<td></td>
<td>Autonomy to select information drives motivation</td>
<td>0</td>
</tr>
<tr>
<td>36 &gt;&gt;&gt;</td>
<td></td>
<td>Accessibility affects motivation</td>
<td>3</td>
</tr>
<tr>
<td>37 &gt;&gt;&gt;</td>
<td></td>
<td>Offering autonomy through explanation of finding sources</td>
<td>1</td>
</tr>
<tr>
<td>38 &gt;&gt;&gt;</td>
<td></td>
<td>Better access to more information</td>
<td>4</td>
</tr>
</tbody>
</table>
Similar to focused coding, pattern coding was applied in order to condense similar codes into broader categories (Saldaña, 2021). Another example of this was in the field journal where, “students were introduced to the topic in a scaffolded way”, which was designed to address this potential need for clarification and understanding within the context of the intervention. This was designated the code *FCM enabled more differentiation in learning, understanding and instruction* along with the code *FCM with students with organization* that were later merged under the category of *FCM benefits to learning and understanding*. This category addressed the approach of the initiative, being of an FCM design, to determine if there was an observable impact on learning and understanding.

<table>
<thead>
<tr>
<th>Order of Code in List</th>
<th>Nested Level</th>
<th>Code Name</th>
<th>Number of Snippets</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>&gt;&gt;</td>
<td>FCM benefits to learning and understanding</td>
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<tr>
<td>8</td>
<td>&gt;&gt;</td>
<td>Efficiency’s role in learning and understanding</td>
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</tr>
<tr>
<td>10</td>
<td>&gt;&gt;</td>
<td>Project promoted understanding and engagement</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>&gt;&gt;</td>
<td>Clearly defined outcomes facilitate learning</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>&gt;&gt;</td>
<td>Engaging in collaborative opportunities to increase efficacy and understanding</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>&gt;&gt;</td>
<td>Increasing levels of engagement</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>&gt;&gt;</td>
<td>Understanding the full scope of the project</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>&gt;&gt;</td>
<td>There have been little to no noticeable changes in the intervention</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>&gt;&gt;</td>
<td>Motivation and Engagement were not really changed throughout</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>&gt;&gt;</td>
<td>Autonomy to select information drives motivation</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>&gt;&gt;</td>
<td>Increased motivation is connected with autonomy and engagement</td>
<td>0</td>
</tr>
<tr>
<td>43</td>
<td>&gt;&gt;</td>
<td>Personal connections affect learning and engagement</td>
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</tr>
<tr>
<td>47</td>
<td>&gt;&gt;</td>
<td>Positive feelings help with understanding and productivity</td>
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</tr>
<tr>
<td>53</td>
<td>&gt;&gt;</td>
<td>Effects of intervention on PL</td>
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</tr>
<tr>
<td>57</td>
<td>&gt;&gt;</td>
<td>PL has been influenced by the project’s scope</td>
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</tr>
<tr>
<td>62</td>
<td>&gt;&gt;</td>
<td>PL influenced by understanding and technology</td>
<td>0</td>
</tr>
<tr>
<td>66</td>
<td>&gt;&gt;</td>
<td>Understanding and interest lead to future success and PL</td>
<td>0</td>
</tr>
<tr>
<td>70</td>
<td>&gt;&gt;</td>
<td>The use of technology is beneficial to learning</td>
<td>0</td>
</tr>
<tr>
<td>74</td>
<td>&gt;&gt;</td>
<td>The benefits that technology offers</td>
<td>0</td>
</tr>
<tr>
<td>79</td>
<td>&gt;&gt;</td>
<td>Technology facilitating the benefits of and easing different facets of learning</td>
<td>0</td>
</tr>
<tr>
<td>85</td>
<td>&gt;&gt;</td>
<td>Ability to assess what is needed and accessibility to it</td>
<td>0</td>
</tr>
<tr>
<td>88</td>
<td>&gt;&gt;</td>
<td>Putting into effect what has been learned</td>
<td>1</td>
</tr>
</tbody>
</table>
understanding of the PL of participants. This later facilitated the process in determining themes. In order to better visualize and see the scope of the data, I printed out all the codes and manually organized them as this was a way to visually process and see the categories in a slightly different way. This can be seen in Figures 4.6, 4.7 and 4.8.

Figure 4.6
*The Process of Printed Code Organization*
Figure 4.7
The Second Round of the Manual Process Printed from Delve Codes
It was after this second cycle coding process that categories from focused and pattern coding were generated, where “higher-level themes” (Saldaña, 2021, p. 323) were generated. As the process continued, the refinement of the codes to categories and into the initial stages of themes started to take shape. This process can be seen in Figures 4.6, 4.7 and 4.8.
As this process developed, it became clear that categories such as project promoted understanding and engagement along with clearly defined outcomes facilitate learning could be refined further as they were still quite focused. Broader categories such as project parameters and clear expectations offer more meaningful learning emerged from this further refinement. Other categories that emerged and grouped together were learning that came from motivation and engagement were not really changed throughout as well as there have been little to no noticeable changes in the intervention motivation combined into motivation and engagement have not been affected through autonomy and learning. In the next phase of the second cycle of coding process, a clearer picture and better understanding of the six emerging categories and how they were generated through the cyclical process emerged as seen in Figure 4.9 and 4.10.

**Figure 4.9**
The Six Major Categories that emerged

<table>
<thead>
<tr>
<th>Order of Code in List</th>
<th>Nested Level</th>
<th>Code Name</th>
<th>Number of Snippets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt;</td>
<td>Understanding and connection effects on learning</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>&gt;&gt;</td>
<td>Applications of understanding</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>&gt;&gt;</td>
<td>Influences on general PL</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>&gt;</td>
<td>Task competency creating deeper understanding</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>&gt;&gt;</td>
<td>Technology's implications on learning and understanding</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>&gt;&gt;</td>
<td>Project parameters and clear expectations offer more meaningful learning</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>&gt;</td>
<td>Autonomy offering motivational changes as a result of deeper understanding</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>&gt;&gt;</td>
<td>Motivation and engagement have not been affected through autonomy and learning</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>&gt;&gt;</td>
<td>Motivation is affected by connections and understanding of task(s)</td>
<td>1</td>
</tr>
</tbody>
</table>
As the data from the initial rounds of coding from the three data sources was taking shape, the result was the culmination of what Saldaña (2021) describes as, “meta codes” (p. 322). As categories were merged and themes developed, the number of entries in each sub-category and category increased dramatically. During this time, notes and memos were made in order to track my thinking and analysis of potential underlying
meanings (Bazeley, 2013; Saldaña, 2021). This was in effect, an anticipated outcome which necessitated the next approach in the coding process, pattern coding. This type of coding enabled the analysis to move into higher-level themes and analyze the summation of the various categories and codes. According to Saldaña (2021), this type of coding condenses the data into more manageable amounts while identifying and refining categories and themes. From this point, Focused coding was used in order to differentiate and select out major themes from the data (Saldaña, 2021).

At this point, categories associated to competence, connection and autonomy developed. This notion of the three tenets of the self-determination theory (Deci & Ryan, 2000) asserted itself as the intervention observation codes seemed to link to these three components throughout. This higher-level view of the themes assisted in viewing the codes and categories that had developed in the initial rounds of coding to determine if there was any type of relationship between them.

As this was a novel study pertaining to PE in an international middle school context, there was still quite some research that posited more to the beneficial side of technology integration as well as autonomy being offered to increase motivation towards learning in a variety of other subject areas, as indicated earlier. Through participant responses, it became clear that they either felt positively towards the experience or at the very least, neutral. There were no individuals that expressed or demonstrated any negative perceptions or leanings towards the intervention. This was evident as the coding process progressed towards themes. Stemming from the categories and themes that emerged, the overall message is that students came away from the intervention with noticeable gains and positive results as Table 4.16 demonstrates.
<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
<th>Assertions</th>
</tr>
</thead>
</table>
| 1. Autonomy offering perceived motivational changes as a result of   | • Motivation and engagement not being affected through autonomy and learning | Students were noticeably engaged with the usage of technology during the intervention. Autonomy of choice enabled students to focus on what their interests were and motivational changes were evident, moving from extrinsically motivated to being more intrinsically motivated learners. “I felt like I had a clear picture of what I was trying to accomplish when I came to class”.
| deeper understanding of physical literacy                            | • Motivation is affected by connections and understanding tasks            |                                                                                                                                                                                                           |
|                                                                     |                                                                           |                                                                                                                                                                                                           |
| 2. Technology increasing physical literacy through task competency   | • Technology’s implication on learning and understanding                   | Students understood the task clearly and questions to do with the project were generally specific to a particular situation. The questions and inquiries were specific and demonstrated a deeper understanding of the task. “I find myself understanding more about my project the more I work on it”.
| and deeper understanding                                             | • Project parameters and clear expectations offer more meaningful learning |                                                                                                                                                                                                           |
|                                                                     |                                                                           |                                                                                                                                                                                                           |
| 3. Connections and understanding effects on increasing physical       | • Applications of understanding                                           | The intervention enabled students to apply what they had previously learned in a new context which created positive observable changes in their PL. “I also talk to my friends about projects a lot, so this leads to me sharing my ideas and getting new ideas”.
| literacy                                                             | • Influences on general physical literacy                                |                                                                                                                                                                                                           |
The theme of understanding and connection effects on learning was formed through categories such as applications of understanding and influences in general merging together. The theme here identified how participants felt connected to the task and the group despite doing their own individual projects. The interesting insight this offered was, due to Covid restrictions affecting the normal day-to-day conduct of lessons, students still felt connected due to the blended online and in-person curriculum that they were a part of for this intervention and during this time.

The theme of task competency creating deeper understanding presented itself when identifying technology's implications on learning and understanding and project parameters and clear expectations offer more meaningful learning were combined. These categories all identify different aspects of competence, which ultimately determines the significance of whether or not a blended curriculum influences the PL skills of learners. Evidently, there are many factors as observed, that contribute to this outcome and the ability to identify if an intervention’s pedagogical design has an impact on learning. In this case as it was observed through different facets, it is clear that competency does link these categories.

The last theme crystalized began to take shape early in the coding process as it pertains to the study in general, autonomy offering motivational changes as a result of deeper understanding. This encompasses a large number of codes and categories collected and identified in the three data sets. Categories such as motivation and engagement have not been affected through autonomy and learning and motivation is affected by connections and understanding of task(s) despite having very different interpretations, still fell under the umbrella of this theme. Participant’s abilities to work
independently outside of class as they simply did not have the time in class to complete every task, played a role in their success, especially given the circumstance of Covid lockdowns be present.

**Themes and Interpretations**

As I looked through the data, coding and categorizing it, three distinct themes emerged. The three themes which evolved from the data were: 1) Autonomy offering motivational changes as a result of deeper understanding, 2) task competency creating deeper understanding, and 3) understanding and connection effects on learning.

*Theme 1: Autonomy offering perceived motivational changes as a result of deeper understanding of physical literacy*

When offered autonomy and control over the various elements of the project, participants became more engaged and interested in what they were learning. As understanding grew, so did their motivation to learn. As students learned more, they increased their knowledge of PL.

When examining the codes and categories in more detail, it became apparent that there were common ideas developing. Motivational shifts through the lens of the self-determination theory (Deci & Ryan, 2000), became apparent through the examination of interviews, observations and reflections, where the data collected in this study, revealed a noticeable shift amongst students from more extrinsically motivated in their initial interest in the intervention to a more intrinsically driven response as the intervention progressed. This was particularly evident with the general outcome of the students’ final presentations. Through the process of triangulation, it became clear through comments from learner that the effects of the intervention motivated them to take ownership of their
learning and moved from an initial extrinsically motivated project to a state where the majority of the participants demonstrated a self-directed initiative towards their own learning, an excitement with their own exploration in what they wanted to develop and create. According to Bryan and Solomon (2007) this would indicate that students were more likely to find success with their endeavor. According to the findings that emerged from the data, this occurred due to several contributing factors, a) personal interest vested in the parameters of the project as well as b) expansive availability of resources that they were able to access through technology. Through class observations, interviews and journal reflections it became clear that students felt, with the autonomy that they were offered, to take their projects in a direction that they felt comfortable with. The observed phenomenon that occurred from this was that the grade was less important and focused shifted more to what they wanted to include and how the process that they would follow would achieve this.

**Personal interests vested in the project.** As learners become more invested in a task and feel autonomy in regards to the development of it, Cecchini (2011), postulated the likelihood of a motivational shift to occur is likely and expected. Learners were able to gain understanding and confidence with the project tasks that were identified by students as “clear”, increased levels of confidence and awareness demonstrated by creativity and engagement during the observation process.

Ownership and purposeful design were integral to the outcomes of understanding on the effect of what autonomy offers to students with understanding their perceptions of how the intervention impacted their PL skills. Enabling students to determine their area(s) of interest and focus aligned with what research indicates with students being
more likely to perform in tasks that they are comfortable with or feel more confident in. It was clear from responses by participants during interviews and from journal entries such as Pam’s journal prompt two response, she expressed, “I wanted to create something that would interest/apply to me so that I could be more into the overall project” and that “I start to realize how important it is to stay fit and I have also realized that a good amount of people my age don’t do a lot of exercise”. This demonstrated a positive correlation between understanding and awareness in the task that through the development of student self-consciousness led to the increased self-confidence and higher levels of participation in this model. Participants also indicated during the interviews that they had a stronger connection to the tasks given the freedom to choose. The autonomy offered to students was expressed as helping with positive cohesion with the overall project.

Throughout the project it was apparent during observation periods and in the journal prompt responses that the more the students engaged, the deeper the level of understanding became. Approximately half way through the project, this engagement was apparent and noted in the observer’s field journal, the November 1st entry, “After approximately half the class period of students working on their own projects, they were very engaged and settled into their fitness programs”. During this same observation period, it was further detailed in the field journal that, “there was a genuine interest and engagement on the task as the students seemed to be motivated with their own interests being explored”. This was indicative of the SDT framework and the relatedness that students felt towards the task (Deci & Ryan, 2000). The importance of relatedness in its connection to ownership over project scope and design is clear and seen throughout journal prompt 2 responses.
Having control of their own physical development led to more meaningful learning during this intervention. As students progressed through the tasks, the data clearly demonstrated that there was growth in the understanding of what PL was. The steps that the project outlined and required, were an important aspect of this development. As students went through the process, it was evident that they were seeing the benefits of the technology integrated project through access to information in exploring areas that were of interest to them and how they related to what they envisioned. Students further enriched this experience by finding opportunities outside of class to discuss what they were doing without any promoting by the project parameters, this was done organically by the individuals as demonstrated in a journal response from Erin as she described her experiences, “I also talk to my friends about projects a lot, so this leads to me sharing my ideas and getting new ones”. Sharing ideas and thoughts throughout the project was integrated into the project parameters and as noted by student responses, was beneficial in furthering their understanding, which in turn made for a more meaningful learning experience.

As students were encouraged to share and determine themselves what was important to include in their projects, it became evident that they were benefiting from this process. The flipped model presented students with a clear path of tasks that needed to be accomplished when coming to class. Journal prompt two posed this concept and students responded, comprehending the impact of the intervention. Annie highlighted the fact that she has “a clear goal before she comes to class”, allowing her as well as other students to process and digest the upcoming list of tasks needing to be addressed. Class was a time for clarification, sharing and building as Hannah explained it, “I can clarify
with the teacher and I can get feedback from my peers to help me make my [project] even better”. This added to what they had already learned and done in the previous sessions. This understanding of upcoming tasks enabled students to determine what best suited their needs to accomplish and focus on during the class time as explained by Karl, “I have a clear picture of what I want to accomplish because I have a set plan”, emphasizing this notion of the importance of enabling student’s autonomy in choosing what their focus would be. This made clear that there was a deeper level of insight from students towards their projects which leads us to understand that the learning was more meaningful due to the connection and understanding gained from the process.

Autonomy offered to students, in regards to the parameters of the project requirements, were aimed at providing students with the opportunity to explore and design something according to their interests and areas of comfort. In journal response one, we can already see the divergence of individuals preferences, even within the same area or completely different aims. Gerry targeted the specific goal of increasing his vertical leap to help with basketball, while Angela focused her efforts on improving her overall basketball skills. Whereas Karl looked to improve his tennis game for competitions and Annie was looking at ways to become more physically active. From the very beginning, students exhibited a keen interest into how their projects would look and the various elements that they would be including in their final programs. This demonstrated that there was an inherent aspect to the project offered through autonomy that engaged students to pursue their interests in more depth. Students being able to control what they did and how it was presented, innately brought a sense of pride into the project. Leading to the notion that as students were offered more control on the
development of the program, they generally had more pride in what they were doing as it
created a sense of meaning and value to the task. Having that autonomy was noted
several times with comments from participants like Sabrina describing the freedom to
choose as, “Yeah, [autonomy] helped because I got to like choose what it was about and
like what I put into it”, offering insight into the activities and scope selection process’
positive effect on the project development. Another comment that came from Karl’s
interview was that, “you had your idea, but as you went through the project and got more
information, it made you more interested”, further presenting the value of choice in
creating a sense of ownership and pride in the tasks.

The motivation and engagement of students have not been affected through
autonomy and learning. For some during the intervention, the parameters of the project
and its design were an interesting and somewhat engaging task where they put forth a
very good effort along with a strong final project according to the qualitative data
collected, however, it should be noted that when posed the question after the project in
the one-on-one interviews, “do you see yourself trying to learn more?”, Sabrina
responded with an unsure, “I don’t think I’d learn more”. This was indicative of what I
had observed during observations with the completion of the task; once the task was
completed, it was time to move on to the next task/assignment/project. An almost
indifference to the experience, neither positive, nor negative, simply something that
needed to be done, which was suggestive of an extrinsically motivated individual. The
project experience and process did not demonstrate any real effect on the student’s
motivation, which falls in contrast to the vast majority of student responses and actions
observed in the three data sources collected. However, having a project that, as Peter put,
“didn’t really decrease my motivation”, demonstrated that the project was not viewed negatively, simply as a task that needed completion in order to move on to the next thing, which is consistent with the SDT theory. Although this was far from a common sentiment, only two students from the 31, this connects with the overarching theme demonstrating that there are those who did not experience the value, as noted by Sánchez-Oliva (2017) and Ryan (2017), of autonomy creating deeper learning and therefore the likelihood of pursuing growth and understanding of PL.

**The flipped classroom model enabled learners to gain a deeper understanding of concepts**

Throughout the unit, utilizing the FCM framework, students were encouraged by two facets of the model, 1) independent learning, and 2) group learning, where both aspects focused mainly on higher level cognitive skills (Brame, 2013). Working independently, students were as Fred described in journal prompt three, “I felt like I had a clear picture of what I was trying to accomplish when I came to class” after viewing the task design for the upcoming lesson. Students used the time to engage in their ideas that they developed from the materials assigned before the lesson (Chen, 2016). This time during the lesson was then allocated to offering feedback on what the students were engaged in.

Students generally utilized the time allocated for the project in class quite well. This was evident in the data provided, particularly as summed up in journal prompt two response where Erin described her process as, “When I come to class, I have a clear picture of what to do because I always planned what to do before coming to class”. This was on account that information and context for the upcoming lessons were provided in
advance as part of the FCM. This was a critical component to enable and empower students to be engaged in their learning as was evident when Karl stated in his journal response two that, “I have a clear picture of what I want to accomplish in the program, because I feel like it has been explained well”. This again demonstrated the value of providing learners with the tools they need to achieve success in an FCM setting. This also afforded them the opportunity to explore and practice what they were interested in during their project development. This enabled independence for students, creating a sense of ownership and developed a meaningful project on their own accord, critical in supporting this sense of autonomy.

As part of the project parameters, there was an aspect of group collaboration, where students were able to work with one another and exchange ideas and information sources offering further motivation towards the learning outcomes Pam commented, “I also like working with my peers because they have given me great information.” In journal response one. Given that the small group collaborations according to Saterbak (2016) provide learners with a deeper learning experience, which is associated with their motivation to learn, involvement such as this student’s, was afforded throughout the intervention. As noted in my field journal, “students were interacting with one another to discuss with peers, specific sites and sources that they had found and shared them with each other.”, demonstrating, as supported by Clark (2015), an increased level of engagement from the initiative.

Expansive availability of resources accessible through technology enabled collaboration and sharing to took place in the initial stages of the intervention. These were such, that they added a lot of value to the learning experience according students.
Through access to a variety of technologies and resources, students had many tools at their disposal and should be noted, this was the intent of the project design (Sharom & Kew, 2021). With the availability of a wide variety of resources, students found that without technology, as Gerry pointed out in his interview “I would not be able to go as far because all the things I’ve looked at, maybe like other people’s workouts…, technology has helped”. This was a common view held by many students and further expressed in the interviews by Freda who emphatically mentioned that “I think it’s been quite useful” in reference to just how helpful technology integration has been to the project.

Having access to various technologies enhanced the interest in project. Given the parameters and setting of where the intervention took place, technology was, in effect, a necessity to ensure that time was well spent. The use of technology gave access to information that students would likely not have explored if done through other means such as a visit to the library. “With the library, you would have to look, it isn’t open all the time, but with technology you sort of have that freedom of like, you can choose when to do it…”, Karl offering insight during his one-on-one interview directed at the importance of having the perception of not wasting time for students being a concern. As the class time was already primed with the flipped lesson, the effectiveness of this strategy was evident in the economy of time and enabling students to come to class with directed questions in regards to technology use and applications. This offered a sense to students that their time was not being wasted, despite that reality being arguable. What this meant was students were directed to resources that were specific to what they wanted to find during the allocated class time. This in-turn meant they were less likely to be
frustrated or overwhelmed with an abundance of other resources or process that might not have been applicable to their specific parameters or goals. Sabrina noted that she was able to “search up what I want to do”, or information that she wanted specifically to find. Effectively this increased their interest in the project and its design which led to more engagement.

With ease of access increasing likelihood of engagement, students found they were able to easily access information, search out specific things they felt were pertinent to what they were interested in. They found a variety of examples for levels of interest and difficulty, and it was apparent that accessibility led to more engagement. As noted during an observation in the field journal on November 9th, “technology applications offered by other students did seem to offer deeper understanding for students, as commented on by many and more effectiveness in how to use some of these sites and exercises”. As confidence in the learner increases from understanding and a sense that they are able to perform the rigors of the activity or task, their engagement increases as the shift to being more intrinsically motivated has a positive correlation with this according to Deci and Ryan (2000). By offering the learners autonomy on their selections, and increasing their resources to pursue what they were interested in. Ulstad (2019) outlines that, removing the external pressure of following a set of tasks that have little connection to their interests, relieves some external pressure and creates more active participation and engagement in the set of tasks.

**Summary.** Throughout the unit, students were offered autonomy within the decisions they made according to the parameters of the project. This autonomy was given in order to determine if there were any measurable changes in their motivation and
whether or not these changes moved from an extrinsic sense towards a more intrinsic sense of motivation. For most, the sense of interest and value placed in their overall physical wellbeing led them to be mostly motivated, which was demonstrated in the journal responses as well as the observations in class that took place. Furthermore, students across the board received mastery for their projects, as without exception, they all aligned with meeting the projects desired learning outcomes and were able to demonstrate as such with the projects that they submitted and presented. This was indicative of the effects that the FCM had on student performance and understanding. As Brad noted, “I had a clear picture of what I wanted to accomplish because I spent a lot of time on my TFP and I gave it a lot of thought and thought about how I would execute it to make my TFP more interesting and for more people to want to do it” which demonstrated that the projects were thoughtfully researched and developed by each student, a real sense of ownership and pride. There was a vested interest evident in the creation of the projects.

**Theme 2: Technology increasing physical literacy through task competency and deeper understanding**

The parameters of the project were designed to challenge students, but do so in a way that is still at grade level. By creating tasks that students feel competency in, a desire to engage in more learning is established leading to a deeper understanding of the project. In this intervention, corresponding to the theme of task competency creating deeper understanding, it was identified by participants in this FCM as having a positive correlation with their PL skills. The ability of a participant to select their focus, and design their project around areas of comfort and strengths, increased their ability to
successfully construct a program that enabled them to feel a level of confidence towards what they were doing, which in turn nurtured their understanding and desire to engage the activity on a deeper level. According to notions based on Hodge (2012), individuals that perceive themselves of having a certain skill level in a specific physical task possess perceptions of competence. The result of this is that participants were willing to take risks and challenge themselves in creating a deeper understanding of the task as demonstrated by the number of participants which was described in journal prompt two by Barb as, “I have a clear picture of what I want to accomplish in the program, because I feel it has been explained well”. This sense of competency was created by clearly defined set of steps for each part of the project in the FCM. This was reinforced by Kelvin’s perception when he responded “I find myself understanding more about my project the more I work on it” in journal response one. This being another indication that as the competency of the learner is reinforced, so too is their level of understanding of the learning outcomes.

**Technology's implications on learning and understanding.** Technology integrated into the curriculum affects the experience of the learner of the learner generally in positive ways. The various data sets collected from the 31 participants demonstrated overwhelmingly that technology’s impact on learning was felt to varying degrees by all participants in generally a positive way. From basic searches, to convenience, or the ability for in-depth research in regards to their own specialized workout programs, students commented on how technology made information more accessible as mentioned in some form or another by Gerry, Sabrina and Peter in the one-on-one interviews. This accessibility in turn increased the learning taking place as students had more time to research and explore by not having to work around a library’s
hours outside of class time. Of course, trips to the library could have been incorporated into the class time, however in this event, kinesthetic exploration with various exercises would not be feasible in a library setting and time would have to be split between two different physical locations. This approach was not pragmatic and given the much broader scope of online resources generally available for this topic online versus a physical location, this was a better utilization of time for this aspect of the project. The use of technology facilitated the design of this FCM, generating positive outcomes with the project and its benchmarks.

The use of technology is beneficial to learning particularly when identifying the practicalities and benefits of technology within the scope of this project. Students, in this case Gerry, seemed aware that technology “has been very effective because if I tried doing this project without the use of technology, I would not be able to go as far”. Gerry went on, “because all the things I’ve looked at maybe like other people’s workout[s]… technology has helped me find various different exercises”. Technology allowed students the opportunity to expand beyond a simple set of exercises; it gave them access to variety and levels in order to differentiate. Through this process, students were able to tap into some of the benefits of resources available through technology. They furthered this through collaborative online resource sharing and peer editing. The benefits of peer sharing and working collaboratively was that students further increased their databases of information. They now had far more to select from and understand various contexts and applications for the usage of these different resources.

The benefits that technology offers, as noted by students, a plethora of benefits. More specifically in this context of, collaborative tools, resources, exemplars,
opportunities to enhance script with tutorial videos, time saving and beyond. The
majority of students noted or demonstrated that without the use of technology integration
to this project, they would not have been able to “go as far” and according to Peter,
technology makes it “easier or more efficient because it allows you to cut out the useless
parts”, as he pointed out during the one-on-one interview. During observations, it became
quite clear that students had diverse ways in which to utilize resources and what was
striking, was how they shared these ideas so effectively with one another.

Organizationally, technology helped students keep their ideas and resources
ordered, which in the case of some students motivated them more. Peter described it as,
“I think it just motivated because I love doing projects like these where it’s just getting as
much information as you can, organizing it and putting it up in a fun way”, in the
interview, signifying how technology has acted as a tool for increasing the interest and
enjoyment in learning. This important facet of technology demonstrates a positive
cohesion that learners have with technology and a worthwhile opportunity gained from its
integration into the FCM.

FCM benefits learning and understanding from the project’s intended outcome by
implementing the model in this type of project, which demonstrated the fundamental
basis of the framework providing differentiated learning along with high levels of student
engagement. Students did not need to be prompted in order to stay on task, they naturally
were inclined to do so, as noted during the class observations. The journal responses in
particular projected this with the vast majority of students commenting similarly to
Heather in journal prompt three that “I had a clear picture of what I wanted to
accomplish”, so she was “able to do everything in the lesson” that needed to be done.
Hannah saw the efficacy of the FCM by acknowledging that “Yes, everything makes more sense and it’s good coming to class because then I can clarify with the teacher and I can get feedback from my peers to help me make my TFP even better”, underscoring the impact of the model on learning outcomes and adding value to the learning experience. As affirmed by the majority of students in journal prompt 2, they had a “clear” understanding of what they needed to accomplish during their time in class. This was primarily due to the FCM and the integration of technology in each part of the process.

Technology facilitated the benefits of and easing different facets of learning. As students acquired and accumulated resources, Peter during the interview described this as, “it allowed me to basically, made my research more efficient and more, I guess accessible”. This was done by enabling him to “find more information or clarify other things for my project”. Again, this type of response was noted from many in various forms through class observations, interviews and journal prompts, reinforcing this sentiment.

**Project parameters and clear expectations offer more meaningful learning.**

When learners have a clear direction and understanding of what the assessment expectations are they are far more likely to achieve success and see the experience as more meaningful. Having the FCM in place and differentiated learning offered when students come to class, enabled students to clearly understand what was being asked of them and how to fulfill these expectations. As there were various aspects within the technology integrated design of the project, it was critical for success to ensure that all aspects were laid-out clearly for students to follow. As this was noted by many students as the case in journal prompt 2 responses, the efficacy of this objective seemed to be
reached. As the final assessment of all but two students were assessed as mastery, it was clear that the project objectives were attained and the students benefited from the overall experience.

Efficiency’s role in learning and understanding was an obvious factor throughout the intervention. During this time, when students were able to access information easily and find what they were searching for rapidly which keeps them on task, engagement had a visible increase as noted in the field journal on November 9th responses of students calling it “more efficient”. This was further reflected by Karl during his interview as he recognized “It’s a lot easier because you can just look it up on the internet and then do it”. Students were on task and working collaboratively on a variety of different aspects in relation to the project. It was clear that this relationship of efficiency, interest and enjoyment created a higher level of motivation to learn. As Peter put it, “the efficiency of technology being able to instantly find what I’m looking for allows me to have more motivation to do it”. Higher levels of motivation having a positive correlation with learning and understanding as we see this shift towards students being more intrinsically motivated and finding they get more from the learning experience. The end result of the project anecdotally, was a level of mastery that surpassed the general grades of previous assessments. Students had a number of tasks to complete and research over an extended period of time. Throughout this time, they were motivated and engaged at a fairly high level. To consistently have this level of engagement from the vast majority of participants demonstrated that technology integration enabled students to have a higher sense of accomplishment, which in turn increased their motivation towards this project.
The project promoted understanding and engagement throughout. There were specific areas in which the project promoted understanding and engagement. As the project had a clear objective, scaffolded with the various lessons using an FCM framework, students were clear in what they were doing and how to accomplish this. “I have had mostly a clear idea from the beginning because I believe the instructions are clear” as described by Fred in journal response two. It was noted that some areas of the project received more attention than others, such as the exercises over the recovery, or the nutritional portions of the program, however, overall, it was evident that students were focused on what they wanted to achieve and went more in-depth with their interests. There was a connection where by the end of the project, students felt a responsibility to continue on with what they had done and for the most part felt a sense of pride in their work as a student indicated in journal prompt three, the final prompt of the intervention. Sandra felt, “I did a good job making a clear vision of my project”, while Vince described his as, “I think my program turned out the way I had envisioned it at the beginning. I think I met my original goals and also managed to do a little bit extra”. This was indicative of the positive correlation between increasing motivation and interest.

Increased motivation was noticeable as we moved deeper into the project. This was a result of a genuine connection to the tasks being assigned and completed. Through the class observations, it was clear from the November 1st field journal entry that, “as they learned and found more, they seemed more motivated about the process”. During the interviews, four participants, Peter, Freda, Karl and Gerry referenced how their motivation positively changed in correlation with the more depth into which they went with their fitness programs. There was a shift from the initial stages of the project to the
end in how students perceived their understanding, this shift was increased interest and motivation. This resulted in a mastery level across the board for students of understanding and learning as evident in their final projects and presentations.

As students progressed, went deeper with their examination of their own physical wellbeing and PL, their increased understanding was evident in their final assessment. Realizations of the importance of staying fit, and as Bob puts it, “one of those things is to reflect on my own workouts and make sure I actually do things right”. This exposed this increased understanding, so much so that a student Gerry notably assessed that the experience helped them in “learning about my learning” which is an incredibly insightful revelation for a student to make when reflecting on their own work. This was further shared by other interviewees in explaining how their understanding developed and the impetus is no longer on them being told what they have to research, but rather that they are interested in pursuing the research themselves as Sabrina commented, “I think it did impact it, because, doing research on it myself, instead of just someone telling me, changed”, demonstrates this shift from extrinsically motivated inclinations to more intrinsically motivated actions.

Clearly defined outcomes help facilitate learning. Using the FCM framework and designing the project steps from the final assessment with a backwards design process, the outcomes were clear from the start to finish with an intentionally scaffolded set of tasks that built upon one another as students progressed. Students had a “clear picture” as Zac put it in journal response three, of what they wanted to do, as well as having well-defined objectives for each class and strategies to prioritize what they needed to do for each class in order to fully benefit from the FCM. The overwhelming number of students
engaged and on task each class demonstrated the value of clearly defined outcomes for this project, particularly identified in the field journal on October 28th. This was further emphasized during the final assessment when all students submitted the completed projects by the deadline without a single extension offered. Student projects all demonstrated a level of mastery in their written forms that was further enforced by their presentations where they showcased their understanding and belief in their efforts. Given that in the final journal prompt, journal prompt three, a commonly held view by participants was that the “project was simple to follow” and the “tasks were easy to do”, exemplifies that despite this being a difficult endeavor, students did not seem to be aware of the complexities that are involved with designing an entire fitness program that is tailored to their own personal needs in a meaningful way, only adding to the evidence that this was a process which really increased their levels of PL and understanding of their own personal health and physical wellbeing.

As the FCM framework design is inherently tailored to the specific needs of a learner, spending the time collaborating with peers and the ability to seek out clarification and further insight from the teacher, ensured that each step of the way supported the learner. Each class meant a new step in the process, which meant that students such as Danny “now when I come to class, I always know what to do”. Erin also commented, “when I come to class, I have a clear picture of what to do because I always planned what to do before coming to class”. Further emphasized by Pam stating “When I come to class, I have a clear picture of what I want to accomplish on my project”. These providing evidence that the FCM framework, with its clearly defined steps, benefits learners. Pam describing how she approached the project, “I noticed throughout the class, I find myself
understanding more about my project the more I work on it”, an insightful commentary indicating the benefits of a clearly defined, step-by-step project. That level of insight and understanding creates competency, which in turn result in a feeling of relatedness for the learner. The result of this is an engaged and enthusiastic learner, who will see noticeable growth over a learner who is unsure of what the intended outcomes are supposed to be and therefore less engaged with the tasks and overall project.

Engagement observably grew with a deeper understanding of the learning outcomes throughout the allotted class time. This was evident and noted in the field journal on October 28th and November 9th. From the initial introduction to well into the latter stages of the project, each lesson brought more understanding and clarity to the objectives, and with each lesson, there was an observable increase in levels of engagement in the journal responses as well as the field journal entries as students further understood the implications of the learning outcomes.

Engaging in collaborative opportunities to increase efficacy and understanding amongst learners. Through the coding process, it became clear that a reoccurring category which emerged, was this notion of students learning how to share and apply their findings while receiving the benefits from the process. Through design and planning, the FCM framework afforded students this opportunity to share findings, compare exercises and offer important feedback to one another in an effort to help improve each other’s projects. This measure was for students to see how various parameters of the project were applied in different settings. This offered alternative ideas for students to interpret the integration of these components into their projects on November 17th. In general, students found benefit in collaborating with one another informally throughout class time which
translated to the efficacy of learning. Pam illustrates, “I also like working with my peers because they have given me great information regarding possible workouts and the layout of my TFP slides”, how collaborative opportunities not only offer helpful strategies, they make the process more enjoyable for students, despite having different projects. They have a shared experience in creating their fitness programs. These opportunities positively correlated with the efficacy of student understanding, particularly with their understanding of PL.

Peer feedback offered in many cases, insight and understanding into the project. It was noted during observations that the inclination of students to be brief rather than exhaustive in their explanations is an area where more time spent would show more effective results. That being said, students did note beneficial interactions with their peers when it came to feedback and advice. Pam spoke to the benefit of this, “I also talk to my friends about projects a lot so this leads to me sharing my ideas and getting new ideas”. Sharing resources, technologies and project format ideas were at the top of the list when it came to types of feedback where students noticed the most benefits according to some of the responses in journal prompts 1 and 2. Through class observations it was visible that the journal prompts reflected what had been observed during class time, best described by Pam as , “I like working with my peers because they have given me great information regarding possible workouts and the layout of my TFP slides”. This consistent message, supported by my field journal observations, puts forth that collaborative work, when evaluated through assessment scores, student reflections and lesson observations, directly demonstrates the efficacy of the process towards increasing student understanding.
Due to the nature of the FCM, students came to class with clear objectives and ideas leading to more engagement. Time spent in class was for exploration and understanding. Through observations in the November 1st field journal, it was clear to see that students enjoyed the project tasks as they were viewed discussing their choices, sharing resources and demonstrating their ideas to receive feedback from their peers. There was genuine enjoyment visible in both groups, which was supported during the interviews with the reiteration of how Sabrina described, “I learnt more, I was motivated” and Freda discussed her views over the course of the intervention when speaking to her progression up until the end of the intervention with, “…and towards the end, I was like, oh wait, this like makes sense and I was like more motivated towards the end”.

Autonomy offered students freedom to pursue what they were passionate about, and offering them this inherent joy and pride within the work that they were doing. This was embodied particularly with the entire scope of the project being more than simply a series of exercises; the project was comprised of other components such as rest/recovery, sleep, and nutrition being part of the complete project, otherwise what could be defined as a holistic approach to PL and physical wellbeing.

A holistic approach to the project was imperative in order to gain the full benefits of understanding what physical wellbeing is. This complete picture understanding did not come immediately for students as demonstrated in journal prompt one responses. It was not until journal prompt two responses that it was clear for students that the scope of this project went beyond simply organizing a series of exercises; it became apparent that beyond the differentiation of exercises, nutrition plans, rest and recovery routines and other attributes needed to be integrated in order to ensure that they were meeting the
criteria of the project. This was most evident when Angela discussed the perspective of where her focus was, as she described, “It is mostly clear of what I have to do. I am currently working on doing the videos for each workout and I still need to make a nutrition schedule”. These various elements beyond the exercises were areas of wonderful discussion during class time. Students were sharing thoughts, while determining if these points they discussed fit into what they saw as important aspects to include within their own plans. As the dialogue between students developed, so did their ideas. For many students, it became clear that the need for tutorial videos on performing exercises and their variations grew and for one student, they added a video tutorial on recipes for some of their healthy foods that they were recommending along with other attributes from their programs.

**Summary.** Throughout the unit, it became apparent that an organized, structured set of tasks, culminating in a meaningful learning experience are incredibly beneficial to learning and creating deeper understanding. Through the implications of technology integration on learning and understanding, it became evident that the FCM was effective and offered, as Vince stated in journal prompt two, “I have come to class with clear ideas of what I wanted to accomplish” which was a direct result of the learning model. Understanding how clear expectations and parameters are critical in making a more meaningful learning experience is a critical component and noted throughout the observations, journal responses and interviews alike. This was most apparent in how student responses in the third journal prompt demonstrated their understanding of what it is to have a meaningful program for themselves as well as keeping the potential needs of others in mind.
Theme 3: Connections and understanding effects on increasing physical literacy

Throughout the intervention, students engaged in tasks that contributed to the understanding of PL, through this process, they gained more understanding of the value of being physically healthy and active. From these tasks, aimed at their own personal interests, students grew their knowledge and connection to the topic of physical wellbeing and activity, which in-turn increased their PL.

In providing the initiative through the framework of an FCM, with a technology integrated, transdisciplinary approach, participants were able to experience two types of connectedness in this intervention. One aspect was a connection with the project itself through the selection of their own path and the other facet being the connectedness of collaborative aspects of the project, designed to enhance the various tasks. By enabling learners to determine their own project themes and aims, the general perception was a sense of ownership and control. This aspect of the intervention was particularly evident during the observations of the final piece, student presentations. Collaborative tasks meant that students were able to gain insight into their own endeavor. The level of understanding and personal implications of the knowledge and understanding that they acquired in their own research through these means was apparent. Peter exemplified this when he described his experience with the project as, “I now understand a lot more, so I can put into practice and learn or use it as effectively as possible”. Having this personal connection to the project design and content, exemplified participants understanding of the importance of PL as well as the likelihood of them continuing on with these healthy habits. Self-awareness of connection was also on display with disclaimers offered by
participants. It was clear that participants had the insight that their programs were not for everyone.

**Applications of understandings.** As students progressed through the various stages and tasks completed in their projects, they found themselves having to assess some key components of conceptual understanding and where it applies. The FCM framework in combination with collaborative opportunities offered students the ability to formulate ideas as to what is needed for their final projects as well as the ability to differentiate superfluous components for their particular project versus potentially necessary for others. Gerry identified this notion when they described, “what I do is try to understand all the pieces of information, and then it just comes clear, about, like what I need, and what I don’t need”. Students found that the autonomy, guidance and support that they were offered enabled them to determine what was pertinent in alignment with what they wanted to achieve. This highlighted their understanding of how components connected to their overall understanding of PL which positively correlated with their understanding of the project parameters.

As was evident in student engagement, the investment students had in their projects lead to seeking out more information and further understanding. This in turn pushed students to doing more with the tasks and various dimensions of the project as their understanding grew. The continual engagement that students felt furthered this idea of knowledge leading to more inquiry. The vested interest of personal pursuits being incorporated, aided in this phenomenon. Freda exemplified this personal connection to her fitness program and identified that, “I’ll keep it, it’s a long-term thing”. With more personal interest invested in the outcome of the project, the connection that students
found with the programs that they were designing, enabled them to put into practice what they had learned, which as seen in the interview process. Peter outlined how in his interview, “I have gained some insight and I do think there’s definitely more room for me to improve in that area”. Students planned to continue on with what they had learned and apply it to their own lifestyle choices and being physically active. As PL is a lifelong understanding of the value of being physically active, this commentary was indicative of the effectiveness of understanding and connection to the learning taking place.

Personal connections to the project were a critical component in maintaining a high level of engagement, going beyond and promoted a personalized fitness program that incorporated more than a set of workouts. This program incorporated all aspects of fitness including nutrition and rest among others. As Pam noted, “I wanted to create something that would interest/apply to me so that I could be more into the overall project and also somewhat know where to start my workout program”. She also described her creation process as, “the steps that I took in order to determine my focus for my fitness program included making a mental list of active activities that I do (and enjoy)” offering more insight as to just how important that personal connection to the task is in order to achieve the most success possible. Again and again, students reiterated that the personal connection that they had with the project is what developed their interest as well as their understanding. The same held true in my observations as noted in the field journal, particularly November 1st and 9th. It was clear as the project went on, the interest of students grew and for many it turned into a passion project. Students were eager to develop their fitness programs, their nutrition plans and build-in rest as well. When
observing students, it was often noted that they were very interested in sharing their ideas and findings with others. This was an indicator of pride in what they had learned.

Student perceptions on how they develop their learning through collaborative interactions during the intervention were apparent as Pam noted that, “I also talk to my friends about projects a lot, so this leads to me sharing my ideas and getting new ideas”, as well as Hannah commenting that, “I can get feedback from my peers to help me make my TFP even better”, clearly indicating the perceived value of this experience.

**Influences on general PL.** From the start of the intervention to the end, students demonstrated growth and understanding in their development towards PL. There were several factors throughout the intervention that through evaluation of the qualitative data demonstrated a positive correlation with PL. The intervention itself, the intervention’s scope, the technology integration as well as student’s thoughts to the future and their personal physical wellbeing were all factors contributing to their general PL. The feedback from students, as well as the data collected from the observations indicated that there was demonstrable growth throughout the process culminating with the mastery level achievement by all students in the final project and presentation assessment.

There were several factors that affected the outcome of the intervention on students’ PL. As the project design offered autonomy to students with their workouts, nutrition, rest and other areas, it was clear that this had beneficial outcomes on the general PL of participants. It was observed that through the project design and scope, understanding of how this project contributed to the overall health and wellbeing of students was understood by participants. The realization of why PL was important and how to connect with the concept on a personal level became apparent, particularly with
the student interviews at the end of the project. A shift in understanding as to the
importance of physical wellbeing was evident when the program was tailored to the
individual creating it. This was noted in a positive context for Gerry, Peter, Freda and
Karl, while Sabrina was somewhat indifferent to the experience, however overall, she
displayed understanding and growth. This was particularly evident in her journal
response two when she commented that, “I came to class with a clear template of my plan
and I understood what I was working on” demonstrating that regardless of her feelings,
the organization of it all facilitated her growth and understanding. The freedom to pursue
activities that appealed to each individual aided with buy in and according to the data
collected, had a positive effect on interest and engagement. This coupled with an
understanding of making the project accessible to others, deepened the PL of students.

One aspect of the intervention that for various reasons did not impact the PL of
students was the transdisciplinary aspect of the intervention. This was seen as attributed
to the fundamental reason that in the previous year, where the foundations of what
students were supposed to have covered in various curricula, offering added value to the
intervention, were not met as they would normally be due to the Covid 19 virus
impacting face-to-face teaching time in the previous year. This knock-on effect became
particularly evident with the responses in journal prompt 3 where in most instances
students described the transdisciplinary skills that they used as fairly rudimentary and
basic. Sandra noted that, “I think my skills from Language Arts and Social Studies really
helped here”, yet could not identify which specific skills those were. Bob felt that, “the
analytical skills form Social Studies, Language Arts, Science and other classes worked
well”, again identifying classes, and not nailing down the specifics of what skills those
were. Generally, the skills mentioned were simple math, generic writing learned in Language Arts, and presentation skills from social studies classes. Students did identify that these skills were useful, however, based on the data, these transdisciplinary skills had little to no effect on the overall impact of the project on their PL.

The project aimed to measure the general influences on PL through offering autonomy and opportunity to pursue areas of interest that appealed to each individual while following the parameters of the project; this in itself was intended to promoted PL. As the intervention progressed, so did the PL of the participants. This was evident in the acknowledgement of students on how they developed their programs, as well as how they altered them depending on how their needs shifted as they shared and learned more throughout the process as noted in the observations. Students demonstrated a sense of accomplishment as they reflected on their work and ensured that it met their desired outcome. That in itself demonstrating growth in and awareness of PL. The project from start to finish, offered and forced this opportunity to gain further understanding of PL through sharing and organically, which students according to the observations that took place, correspond with this finding.

PL has been influenced by the project’s scope and throughout the project, students were challenged to design a fitness program that addressed several facets of overall physical wellbeing with the scope of the project targeting PL. There is little doubt that the final projects and presentations submitted, demonstrated a mastery level of understanding and accomplishment for students as well as an awareness that the impact of the intervention had, however, it could be argued that regardless of the intervention, any sustained time learning a concept will result in deeper understanding. As this is
undoubtedly true, given the data collected on this particular intervention, given the scope of the project and other contributing factors such as autonomy offered, collaborative endeavors throughout and the integration of technology, the feedback, observations and reflections demonstrably confirm that the scope of the project positively impacted the PL of all students that took part in this intervention.

This was particularly evident in the final observation of the project presentations. Students were engaged and fully versed in their projects with, what they wanted to achieve and how to do so, further displaying their understanding of PL and the impact it has on their overall wellbeing. The major takeaway from the assessment, as stated in the interviews, students acknowledged that they were planning to follow these fitness programs in the future for their own personal wellbeing or to help prepare and maintain for an upcoming sport season. This acts as an indicator of a positive outcome with the intervention. The practicality of the program for each individual in its holistic approach to physical wellbeing, contributed to its success. This is to say that students appreciated that the project was more than a series of exercise, and that it addressed nutritional needs as well as rest and recovery, important facets of PL. This project engaged students on a variety of levels which acted as a motivator when it came to PL.

In analyzing the influence that technology had on PL, there were several elements that stood out as contributing factors to determine this as an area of positive growth, no growth or a decrease. The data demonstrated that there was no evidence of a decrease in PL on account of technology integration, moreover, it demonstrated that there was growth, especially give the notion that technology made access to information much easier, particularly when technology and its uses were shared between participants. The
sharing of resources promoted in all events, the understanding of PL, resulting in a
demonstrable increase as noted in the observation field journal throughout the
intervention. Students used a shared Google Doc and Sheet in order to facilitate formal
collaborative endeavors. Informal sharing and collaboration also took place throughout
the lessons. These opportunities afforded students the chance to compare notes and
resource share which positively influenced their PL.

In order to determine if the intervention would have any real impact on the future
endeavors of students in being more active and furthering their understanding of the
benefits of PA and PL, the need to determine their levels of interest would need to be
investigated along with measuring their understanding of the impact that increasing their
level of PL would have on their overall health and quality of life. Through analyzing the
data from the journal prompts’ responses, an obvious pattern emerged where students
recognized the value of choosing the focus and aims of their own fitness program and
how it positively impacted their views on PL and what that might lead to in the future. In
general, students tended to demonstrate a genuine interest in pursuing a deeper
understanding of the value of physical wellbeing in its entirety on one end of the
spectrum, while on the other end, simply happy with the knowledge that they had
acquired and content to leave it at that. The outcome of this is that determining what this
age group of individuals will pursue is too difficult to come to any valid conclusion that
would be supported by the data, only time will determine this outcome.

Summary. During this unit, students were tasked with a project that focused on
their needs translated into a fitness program that would be applicable in various situations
for a variety of people. In general, this attributed to a large majority of students not only
being able to connect their findings with their own personal understanding of what PL is, they were also able to understand what they had learned and share it with others. The most interesting aspect of this was how it formed a community of aware and interested individuals that understood the implications of this endeavor.

**Chapter Summary**

This chapter has presented a mix of five types of data sources collected. Both quantitative and qualitative data were collected in this mixed-methods action research study. The pre- and post-intervention data were collected through two instruments, the MSLQ and the CAPL-2, in the form of a pre- and post-intervention questionnaire. Qualitative data collection was made through the gathering of three types of data sources. These sources included student journal responses, a student observations journal and one-on-one interviews. Through statistical analysis, coding and the process of triangulation, three themes developed as a result of this which included, autonomy offering motivational changes through deeper understanding, task competency creating deeper understanding, and understanding and connection effect on learning.
CHAPTER 5

DISCUSSION, IMPLICATIONS AND LIMITATIONS

The purpose of this action research was to evaluate the implementation of a new flipped classroom, technology integrated, PE unit in order to increase eighth-grade students’ PL knowledge at an international middle school. This chapter discusses the findings of this action research study framed around the research questions. Implications for future studies in the field as well as future iterations of it are explained. Finally, limitations of the study are acknowledged in this section.

Discussion

It is important to situate the findings of this study within the broader context of the greater body of research and literature. In order to answer the research questions, through the lens of a technology integrated, flipped classroom, transdisciplinary design, motivation towards PL and how it was applied in analyzing the data collected. This discussion is organized into three sections, one section for each research question.

RQ1: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ motivation to learn about physical literacy?

This research question arose from the desire to see if motivation of learners towards PL was influenced by the integration of technology into a PE curriculum unit, particularly when an FCM framework integrated with cross-curricular components of the STEAM model were
overlaid in order to address this facet of learning. Through the analysis of the data sets, it was clear that the technology integrated FCM unit had a substantial effect on the learner’s motivation to learn about PL. The intention was to incorporate strategies and tools to facilitate the flipped classroom that are commonly seen in other subject areas and placing them in a setting, PE class, which was somewhat novel and limited according to Ferriz-Valero et al. (2022), particularly at an international middle school setting. In order to determine the effect that this intervention had on participants and if it aligned with parallel models. To investigate this, the MSLQ and one-on-one interviews were utilized as the main data sources, however the CAPL 2 pre- and post-intervention questionnaires along with the qualitative data sources of observations and journal prompt responses aided in painting an overall picture of the interventions effect on students’ motivation towards PL. The results from the qualitative and quantitative do paint somewhat of a different picture from one another, however given the limited research in the area, it was observed that the qualitative data aligned with the current body of work on the successes of a technology integrated FCM, while the quantitative data demonstrated slightly differing results in accordance to the success of the intervention with some of the research (Bergmann & Sams, 2012; Botella et al., 2021; Ferriz-Valero et al., 2022; Jeong & Gonzales-Gomez, 2017). In order to determine the success of the intervention, there are two main areas where the research took us: 1) Factors of motivation, and 2) the effects of the FCM on motivation to learn about PL.

**Factors of motivation.** When it came to the factors of motivation in addressing the effects that this intervention had on the motivation to learn about PL, there were two main facets examined: 1) External motivational factors, and 2) internal motivational
factors. These two facets contributed in their own ways to the interest of participants in different ways to demonstrate the significance and contributions of the intervention.

*External motivational factors.* In order to determine the changes that took place during this intervention participants were given a pre- and post-intervention questionnaire, the MSLQ. From this it could be determined if there were any change in motivation from pre- to post-intervention through certain sections of the MSLQ that would indicate external factors affecting the motivation of participants. These external factors, in support of the qualitative data, helped determine the alignment found in the research, and the positive effects that this type of intervention has on motivation to learn, specifically in this case of PL according to the body of research (Barrett, 2012; Batastini et al., 2018; Bergmann & Sams, 2012; Bonk & Graham, 2005; Botella et al., 2021; Ferriz-Valero et al., 2022; Jeong & Gonzales-Gomez, 2017; Kuczala & Lengel, 2017; Li et al., 2019). External factors dictated the trajectory of each participant’s learning to various extents.

Extrinsic goal orientation is based around external motivators such as grades, evaluations or rewards in order to drive an individual to achieve. The main idea is, task completion as the directive or the driving force (Pintrich et al., 1991). From their perception, a learner determines the importance that the participant will place on the activity and from that the effort that they will give towards the endeavor if they determine it to be meaningful (Botella et al., 2021; Ferriz-Valero, 2022). Understanding the value given by an individual to the assigned task is critical in determining the amount of involvement a student is likely to have within their own learning.
As Pintrich et al. (1991), alluded to, task value is associated to the importance that a learner perceives of the task. Aimed to demonstrate a student’s perception of their level of engagement towards the completion of a task, this was used to determine the level of extrinsic motivation they felt towards the completion of a task. When the scores from this subscale, task value, were examined, they indicated similar findings to those of the qualitative findings of the student interviews. The participants in both data sets, the quantitative and the qualitative, demonstrated an understanding of the balance between a meaningful learning experience and the importance of being physically literate, measured against their successful completion of the rigors of the project tasks. The general response to this section of the MSLQ is indicative that students are still somewhat driven by grades, and, for the most part, find a sense of reward when they have done well, which can be directed through effective lesson design (Bandura, 1978; Ulstad et al., 2019). The interviewees support this stance; however, it is apparent that there was less emphasis on grades as the intervention progressed and more on the understanding due to the implications on one’s own likelihood of doing their own fitness program. This, although quite minimal, is supported by the marginally lower scores on the post- intervention questionnaire in comparison to the pre-intervention, which was consistent with the journal responses and one-on-one interviews.

As the intervention progressed, a shift in perceptions of the project occurred and engagement increased as students found themselves more connected to what they were doing. This was in large part given that they had the autonomy to determine where they wanted to direct and focus their attention. Findings where the quantitative data indicated little to no significant changes, such as in this research, were also found to be the case in
similar studies, while the qualitative indicated that there was certainly an engagement factor that was observed (Ferriz-Valero et al., 2022). Students had clear visions as to where they wanted to take their projects and the interviews provided evidence of this and how throughout the projects, interest continued to grow. Despite this shift towards more intrinsically motivated behavior, the external motivating factor of the final assessment was still the end goal, and, evidently a way for students to perceive or interpret their success in the project.

The final assessment for this intervention was used to guide students in their design of a fitness program that incorporated various facets to it, such as exercise, nutrition and recovery. The data collected from the qualitative and quantitative sources enabled the measure of any significant or non-significant changes in motivation of the participants that took place during the intervention. The results between the quantitative findings differed from those of the qualitative in that the pre- and post-intervention questionnaires. The quantitative results did not show any significant changes, while the qualitative findings demonstrated a notable change in engagement and motivation towards the learning that resulted in growth and understanding of PL from the intervention. Studies similar to this, such as Ferriz-Valero et al. (2022), had similar findings, where significant changes were observed and recorded in their qualitative evidence with higher levels of engagement and motivation being recorded in the study’s data. A theme that emerged from this was the connection and understanding effects on learning where students were able to apply what they had learned in the pre-lesson material and apply it to their face-to-face class time. The engagement and motivation during this time was aligned with what Ferriz-Valero et al. (2022) saw in their findings.
The quantitative findings found similar conclusions in this study as did the Ferriz-Valero et al. (2022) study, with no significant changes measured between the pre- and post-intervention questionnaires and the assessment between the two sample groups of the Ferriz-Valero et al. (2022) study. The flipped classroom group and the traditional lesson group assessment scores were approximately the same. Again, responses illustrate the scope of the participant’s understanding of their own abilities, which in-turn impact their motivation towards learning about PL, and according to the quantitative data there were no real changes of any significance towards their motivation to increase their PL.

**Internal motivational factors.** Another area of motivation that led to participants finding a positively related development in their motivation towards learning PL, which aligned with the body of research, were internal motivational factors such as interest and engagement, are targeted by design, increase throughout the course of the intervention (Bergmann & Sams, 2012; Botella et al., 2021; Ferriz-Valero et al., 2022; Jeong & Gonzales-Gomez, 2017; Kuczala & Lengel, 2017; Li et al., 2019; Tucker et al., 2016). This is in part due to the inherent nature of the intervention where participants are encouraged to select meaningful activities that relate specifically to their own interests. By doing this, there was a positively correlated outcome where the student felt better about performing the task (Jaakkola et al., 2008). This was evident throughout JR1 and JR2 respondents. The intrinsic goal orientation of the students was focused on how each participant was challenged, or the curiosity of attaining mastery for their own fulfillment. Participation in the task itself was what was important for the learner (Pintrich et al., 1991). In this case, students were motivated by interest in what they were doing, the intrinsic goal orientation was seen to increase, which was similar to what Botella et al.
(2021) and Ferriz-Valero et al. (2022) found in their flipped classroom setting. The intervention parameters were designed to integrate opportunities that offered autonomy to students, offering choice and freedom. This type of approach facilitates a shift to more intrinsically motivated involvement in the various tasks according to Bishop and Verlager (2013), and Sookoo-Singh and Boisselle (2018).

In general, the responses on the MSLQ for the pre- and post-intervention questionnaires were on the higher end of the scale with an average slightly above or below 5 based on a Likert scale of 7. The pre-intervention scores were slightly higher than those of the post-intervention in four of the subscales, while the remaining two subscales increased from pre- to post-intervention questionnaire. Intrinsic goal orientation (mean pre = 5.11 and post = 4.98), extrinsic goal orientation (mean pre = 5.44 and post = 5.07), task value (mean pre = 5.18 and post = 4.74) and control of learning beliefs (mean pre = 5.65 and post = 5.46) all saw their mean scores decrease from pre- to post-intervention questionnaire. While self-efficacy for learning performance (mean pre = 5.65 and post = 5.66) and test anxiety (mean pre = 4.19 and post = 4.53) means increased. Since the difference was quite minimal, based on the SDT, it appears that task involvement was already high as students were intrinsically motivated by the project itself and demonstrated their interest throughout the intervention, thus contributing to their overall PL and likelihood to pursue life-long participation in PA (Sánchez- Oliva et al., 2017). The qualitative data findings from the student interviews further supported the premise from the body of research, that students already had a high level of intrinsic motivation towards the intervention due to the autonomy offered to them in the selection process (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). Given the design of the
intervention, as indicated by student during the interviews, the technology integrated, FCM seemed to maintain the levels of engagement of the students without any discernible change to their intrinsic motivation and in-turn, their performance throughout the tasks of the intervention further supporting the significance of internal factors on motivation to learn about PL (Ulstad et al., 2019). According to the SDT, this would encourage participants to authentically feel that their efforts would determine the outcome of their projects. The more involved and engaged participants were, the likelihood of success increased. As there were seldom any participants disengaged throughout, the final assessment scores confirmed this. This supported one of Deci and Ryan’s (2000) tenants of autonomy from the SDT; throughout this intervention, the design intentionally facilitated autonomy for the participants in order to encourage them to determine their own learning path. This was further supported by students’ comments during the interview process. Understanding that outcomes were based on an individual’s own efforts were evident.

As a great deal of autonomy was offered to participants in terms of structure and content, the absence of external pressures to follow specific structures that lead to more active participation was observed throughout the intervention and commented upon during the interview process by all five of the interviewees. These were indicative of a progression towards a more physically literate group of individuals (Kirk, 2013; Li, Kam, & Zhang, 2019; Mikaelis, 2018). This was further emphasized through the lens of competency, as participants’ final projects exemplified this aspect. Students comprehended the learning tasks and outcomes highlighted by their summative assessment scores of predominantly mastery, which are indicative of task understanding,
and illustrate their engagement in the process (Harter, 1978; Ulstad et al., 2019; White, 1963). Despite the projects being quite different from one participant to the next, students found opportunities to share and collaborate with one another a variety of ideas. Working together, participants exhibited relatedness, another tenant of the SDT (Deci & Ryan, 2000), where working together motivated individuals to continue to work towards the project benchmarks and outcomes (Baumeister & Leary, 1995; Botella et al., 2021; Reis, 1994; Ulstad et al., 2019). The successful completion of the projects, marked by the assessment results, corresponded with the high pre- and post-intervention questionnaire scores. Despite there being no real significance with the MSLQ results, the already high scores in combination with the qualitative data sets mark an identifiably high level of interest and motivation given the nature of the intervention, as noted by Botella et al. (2021) in their study. Given the relative similarities between the pre- and post-intervention questionnaires, as Ho and Yu (2015) lead us to possibly take under consideration is the potential for a ceiling effect, however, as they go on further to point out, this does not mean that the results are necessarily skewed or invalid, they may simply be coming from a place where the scores are simply high, which given the corroborating qualitative data sets, this is most likely.

The effects of the flipped classroom model on motivation to learn about physical literacy. Students as they progressed through the intervention found the 3-step design of the FCM integrated with technology to address their needs and inclined them to be more engaged with the initiative, typical of this type of approach in comparison with what Tucker et al. (2016) found within their own research. Students reflected upon the initiative and found that there were many benefits to following this type of framework,
particularly as it applied to the project. Despite the pre- and post-intervention questionnaires demonstrating results without any significance, Kay et al. (2019), Gomez-Lanier (2018), and Sookoo-Singh & Boisselle (2018) suggest that despite these quantitative results, the FCM supports active learners as opposed to passive learners which directly affects the motivation levels of students. In this case showing a deeper interest and in turn a better understanding of what PL is.

The objectives were clear that an FCM, integrated with technology curriculum made class sessions more productive, and participants having had better access to information instead of, as participants viewed it, the inconvenience of having to go to the physical library was highlighted by students as particularly beneficial in their motivation to broaden their understanding of PL, a typical understanding of how this type of framework is designed and implemented (Roehl et al., 2013). The components of the intervention demonstrably illustrated how beneficial the framework was for garnering interest and engagement as explained throughout the interviews and aligning with Ferriz-Valero et al.’s (2022) findings in their recent study.

As participants gained confidence and understanding through the FCM framework, it was apparent that they became more confident within the work and research that they were conducting. They also knew that they had the freedom to determine what course they felt best suited them within the parameters of the project which enabled them to feel self-efficacy within the task according to their responses. The more personalized experience that the FCM offered students enabled them to have a more personalized learning experience, which was listed as a critical component in motivating
students to increase their understanding of PL (Jeong & González-Gómez, 2016; Keller, 2017).

Collaborative opportunities, both formal and informal, became a part of the intervention as students took the opportunity to share after viewing the material for the upcoming lessons. They were also offered time within the lessons to collaborate and did so frequently with much success, similar to findings within the body of research (Jeong & González-Gómez, 2016; Keller, 2017). Seldom was it apparent that any individual did not take part in the pre-readings or viewings before class which is typically one of the shortcomings of this type of design (Clark et al., 2016; Roehling, et al., 2017); however, with the design of these materials, they were purposefully done to engage and keep the workload as minimal as possible, which after a few initial problems, the class culture was such that this was of no real concern as evident in the observations. Building this type of class culture takes time and can be a pitfall for many in this type of setting if not addressed (Clark et al., 2016; Roehling, et al., 2017; Sookoo-Singh & Boiselle, 2018).

The impact of the FCM could also be seen in the way that the teacher was able to differentiate the lesson in such a way that all learners were able to receive the assistance and guidance that they needed in order to find success. Differentiation is a key component of the FCM and as students indicated, they were able to come to class and ask their specific questions, indicative of what the research demonstrates in an FCM setting (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). The correlation between quantitative and qualitative data underlines the positive effects that the intervention had on participants’ motivation towards learning about PL. Within the body of research, has shown itself to have a substantial effect on the motivation of students to learn about PL.
RQ2: How and to what extent does a technology integrated, flipped classroom, physical education unit, enhanced with the STEAM model, impact eighth-grade students’ physical literacy skills?

This research question stemmed from a desire to understand how learners’ PL was influenced by the integration of technology into a PE curriculum unit, particularly when an intentional cross-curricular framework such as STEAM, was overlaid in order to address changes in their PL. The various data sets provided evidence that are somewhat mixed in their findings, and thus making it challenging to determine the exact significance of the intervention’s results. The pre- and post-intervention questionnaire, CAPL-2, did not offer any significant results to determine whether or not the technology integrated FCM had a real impact on the PL of participants; however, the qualitative findings did demonstrate a significant understanding presented by students about their PL, aligning with the limited body of research. This was Ferriz-Valero et al. (2022) findings as well where the quantitative findings were not significant, however the qualitative data indicated that the FCM increased engagement and motivation amongst students.

Given the parameters of the intervention’s project, the inherent nature of a project-based design of this type is that learners took with them a level of understanding of PL and the value of being physically active by meeting the benchmarks and standards of the assignment (Mandigoet al., 2009; Sport for Life, 2020; Tremblay & Llyod, 2010). The knowledge and understanding that students gained from this intervention, given its FCM design, was addressed through collaborative opportunities, and offered them opportunities to advance their learning through accessibility to an abundance of resources.
(Roehl et al., 2013). These opportunities increased student engagement, which in turn affected their motivation and confidence. In order to examine the impact that this intervention had on the PL of grade eight students, we will examine two areas: 1) Knowledge and understanding, and 2) Motivation and Confidence in the following sections.

**Knowledge and understanding.** In the context of this intervention, knowledge and understanding represent the intervention design as well as the opportunities the design provided to further engage and facilitate students’ PL understanding and skills. The FCM enabled learners to access information more readily, and increase their understanding of various elements of the project through collaborative means which all align with the current literature that demonstrates how an FCM environment positively correlates with increased interest, engagement and understanding (Batastini, et al., 2018; Bishop & Verlager, 2013; Botella et al., 2021; Clark, et al., 2016; Mok, 2014; Schrlau, et al., 2016;). The intervention demonstrated this through its quantitative and qualitative analysis findings.

In examining the levels of understanding and knowledge gained in the intervention, the quantitative data illustrated an already high level of PL amongst participants with mean scores for boys and girls in the pre-intervention questionnaire situated at the high end of the band, in the *achieving* range. This is likely due to the curriculum from the previous year offering background knowledge to prepare students for the intervention that was supposed to take place in Spring 2021; however, due to Covid restrictions, The intervention needed to be moved to the Fall of 2021. Over the course of the intervention, participants demonstrated noticeable gains in their
understanding of PL through the intervention which was reflected in the interviews and as suggested by the literature, due to the design of the intervention (Botella et al., 2021; Ferriz-Valero et al., 2022). Participant interview responses confirmed this understanding of the impact that being physically active had on their wellbeing and health, aligning with the body of scholarship on PL and the benefits found with being PA (Sport for Life, 2020; Tremblay & Llyod, 2010; Whitehead, 2008). In the post-intervention questionnaire boys and girls moved from the achieving range over to the excelling range. Higher scores directly correlate with a deeper knowledge and understanding that participants acquired over the course of the intervention as they dove deeper into the parameters of the project which aligns with other studies such as Ferriz-Valero et al. (2022) study. As the intervention progressed, the data provided by the interviews substantiated this finding that levels of PL increased, with students acknowledging that the design impacted their motivation to learn and increase understanding as noted in the findings of other studies with a similar design or model (Kay et al., 2019; Gomez- Lanier, 2018; Sookoo-Singh & Boisselle, 2018). This inevitably happens when learners make that shift from passive to active learners.

This movement from achieving to excelling on the CAPL-2 instrument is indicative that there were increases to the level of knowledge and understanding displayed by participants from pre- to post-intervention reflected in the increase scores, similar to what Botella et al. (2021) and Ferriz-Valero et al. (2022) found within the results of their respective PE in an FCM environment. The shift from the achieving band to the excelling band was a fairly small shift one as the pre-intervention scores were at the high end of the band and shifted upwards to the low end of the band in the post-
intervention questionnaire; however, measured over the short course of time, the change
during the intervention is still notable. The reason for this is simply that if there is a
change such as this during a relatively short amount of time, it is reasonable to assume
that over the course of a longer period of time, there would be more significant changes.
The study conducted by Botella et al. (2021), demonstrated that when students are
engaged and motivated, they will see more gains as their motivation to participate
increases, which reinforces the notion of PL increasing over time if sustained. The
inherent quality of PA is that the more you are active, the likelihood of being in better
physical shape increases.

Utilizing the FCM design for this intervention was integral in building
understanding and creating an environment where students were actively engaged in their
process to become more physically literate. Instead of being a passive learner in a
traditional design, they became active learners engaged in the process of learning about
PL in an FCM (Petress, 2008; Swiderski, 2011). The FCM enabled students to come to
class ready to participate and engage in the area specific to the lesson, becoming active
learners in the process. Although a distinction between the results of this method and a
more traditional approach are minimal, the motivation of the learner is noticeably higher
in the FCM format (Kay et al., 2019; Gomez- Lanier, 2018; Sookoo-Singh & Boisselle,
2018). The effectiveness of accessing information prior to class and utilizing the time
together according to Alexander (2018), Aşıksoy and Özdamlı (2016), Chang et al.
(2018), and Isaias (2018) are highly valued. In-line with these findings, students reported
themselves to have higher levels of engagement throughout and therefore increasing their
PL in the process.
The ability to easily access information was another factor that led to higher levels of engagement. Students indicated that being able to access information from wherever they needed to be helped with their interest and ability to connect with the materials, something noted in other FCM research (Roehl et al., 2013). Offering autonomy for learners to access information when they are wanting or able to, empowers them and offers a sentiment of control over their own personal learning as evident in the body of research (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). This is another facet in helping students develop their PL while supporting their individualized needs. In order to accomplish this, better access to materials enables students opportunities to tailor their learning to whatever fits their needs best (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). Accessibility in most cases for the intervention is what motivated participants to go deeper with their projects and build their understanding of PL.

Motivation and confidence. The impact of motivation and confidence is such that they are positively correlated with one another. The self-determination theory is important to highlight here as the design of this intervention was to some extent built around the SDT and its three facets of autonomy, relatedness and competency (Deci & Ryan, 2000). All three of these were factors inlayed into an intervention that was designed for participants to, as Glance et al. (2018) terms it, “learn, expand, engage”, while trying to deepen their understanding of PL. The intent here was to follow the body of research with the FCM to meet all three facets of the SDT.

This is an area specifically where the intervention design targets the motivation continuum in order to measure changes in participants’ motivation to determine if they
move in any direction from extrinsically to intrinsically motivated while creating their fitness program project. The idea being that students that are intrinsically motivated are more likely to acquire higher levels of PL than those who are less interested. As participants emphasized in their interviews that the more they learned and understood about their projects, the more they tailored them to their own needs and interests. This led them to feeling more confident about what they were doing and in turn led them to do more research about their own physical wellbeing and building their PL (Corbin, 2016; Sport for Life, 2020; Tremblay & Llyod, 2010; Whitehead, 2001; Whitehead, 2008). This personal interest fed their desire to seek out more information, and as many commented, helped them to stay engaged and want to pursue more in order to be more physically active. Thus, as the CAPL-2 pre- and post-intervention questionnaire data indicated, an increase in PL occurred.

There were three facets to the intervention design that enabled the intervention to increase the PL of students. Ownership and purposeful design, were integral to the outcomes of understanding on the effect of what autonomy offers to students with understanding their perceptions of how the intervention impacted their PL skills (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). Enabling students to determine their area(s) of interest and focus aligned with what research indicates with students more likely to perform in tasks that they are comfortable with or feel more confident in. (Van den Berghe et al., 2012). According to Jaakkola et al. (2008) there is a positive correlation between choice and how the learner feels about participating in the activity, which in this case was a self-directed fitness program. Autonomy to select their focus and specific steps and tasks ensured that there was active engagement within the lessons and a
high level of investment, indicative of trends in similar studies (Botella et al., 2021; Ferriz-Valero, 2022). This again demonstrated the value of providing learners with the tools they need to achieve success in an FCM setting. This also afforded them the opportunity to explore and practice what they were interested in throughout their project development (Clark, 2015; Sharom & Kew, 2021). This enabled independence for students, creating a sense of ownership and developed a meaningful project of their own accord, critical in supporting this sense of autonomy (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). A critical component by all indicators.

An additionally important aspect to consider with motivation and confidence of the learners was relatedness. In order for participants to feel motivated towards the goals and tasks of the intervention, they needed to feel connected to it. This connection builds a deeper intrinsic value on the project success and in turn ensures a more motivated participant (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). This is based on what an individual likes to do, or what they are inclined to do because they are more comfortable doing that task or activity. According to the SDT model, motivation will increase when individuals are presented with tasks where they have a sense of relatedness to them, further supporting this intervention’s design (Baumeister & Leary, 1995; Reis, 1994; Ulstad et al., 2019). The intervention presented participants with the opportunity to select tasks that were most in line with what they felt were representative of their ability and met their needs. Students discussed this aspect during the interviews, confirming that the project design enabled them to be selective of what they included and in turn, feel a greater sense of relatedness to the project as other research has shown (Kirk, 2013; Li et al., 2019; Mikaels, 2018). This was confirmed in the mean score of the questionnaire with
an average of 6.4 in the pre-intervention compared to an increase in the post-intervention score of 6.6. Both scores were based on a maximum possible 7.5. These scores reflect averages for boys and girls in the excelling range of the CAPL-2. This was indicative of an increase in PL from pre- to post-intervention and likely would increase if the timeframe of the intervention were extended for a much longer period of time. From this information, it is likely that given the nature of choice and challenge, students inherently pushed themselves further given the context and how their peers were designing and learning from one another through their interactions to continue their growth and have the confidence to do so due to the support they found in the class environment. And as Baumeister and Leary (1995), Reis (1994) and Ulstad et al. (2019) describe, connection and relatedness are meant to enhance the learning experience.

As the aim of the intervention was to employ a fairly novel approach to the PE curriculum according to Ferriz-Valero (2022), to determine if it had any significant effects on the PL of learners, the important component of competency was taken into consideration in order to ensure that students were motivated to engage in a project of this nature that might seem overwhelming (Harter, 1978; Ulstad et al., 2019; White, 1963). Competency was used to determine how participants situate themselves in the context of a task or set of activities. Are they able to perform and to what level? This ties in to the competence aspect of the SDT, where the individual determines if they are able to effectively partake in an activity (Harter, 1978; Ulstad et al., 2019; White, 1963). Due to the differentiated nature of the FCM (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017), and the collaborative opportunities provided by it (Jeong & González-Gómez, 2016; Keller, 2017), students were able to feel a higher level of
competency as they were aware of what they needed to do in class prior to coming and while they were in the lesson, they could share ideas and techniques that offered a sense of understanding and competency.

This was supported by the evidence provided by the CAPL-2 pre- and post-intervention questionnaires’ scores for boys and girls were in the excelling range with a mean score of 6.4 and 6.6 respectively out of 7.5. During the interviews, participants reflected on how through help and dialogue with other participants, they were able to expand their ideas and scope of what they included within their projects demonstrating a stronger sense of competency (Harter, 1978; Ulstad et al., 2019; White, 1963). Participants noted that conversations and idea exchange opportunities designed into the intervention aided in this process (Jeong & González-Gómez, 2016; Keller, 2017). This further signifying that the intervention had a positive correlation with students’ increased level PL through competency of tasks and understanding.

Students throughout the intervention seemingly understood the extent to their own abilities when it came to performing some of the skills that they were adding to their projects. This recognition led to students incorporating differentiated strategies that they offer for more advanced learners (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). This was reflected in the interviews as participants noted that they tried to design their programs around their abilities and what worked best for them, knowing that there certainly are more advanced, as well as less advanced options for their specific exercises and programs in general. This awareness of ability tends to be indicative of a more physically literate student (Kirk, 2013; Li et al., 2019; Mikaelis, 2018). This working understanding of a differentiated program while still being aware of one’s own
physical capabilities, does not forfeit the opportunity to add more advanced features if there is a theoretical knowledge to base it on.

Scores along with the responses from the interviews offered insight to the level of PL students achieved. What became evident, was that through the project design, it was clear that students felt there were correlated benefits that came from the intervention. As participants emphasized in their interviews, the more they learned and understood about their projects, the more they tailored them to their own needs and interests. The nature of the FCM led them to feeling more confident about what they were doing and in turn enabled them to do more research about their own physical wellbeing presenting higher order thinking skills as presented in other research (Batastini, et al., 2018; Bishop & Verlager, 2013; Clark, et al., 2016; Mok, 2014; Schrlau, et al., 2016;). This personal interest fed their desire to seek out more information and as many commented, helped them to stay engaged and want to pursue more in order to be more physically active. Thus, resulting in an increase in competency and therefore demonstrated that this intervention design positively impacted the PL of eighth graders.

**RQ3: What are eighth-grade students’ perceptions of how a technology blended physical education curriculum, enhanced with the STEAM model, impacted their physical literacy skills?**

The main objective in addressing RQ3 was to determine if the use of the FCM developed students’ understanding of PL and how students perceived doing so. Through analysis of the data sources and alignment with the limited body of research, it was clear that the intervention had a significant impact on PL as perceived by students. This was demonstrated from the initial beginnings of the intervention, an aspect of the design
implemented was to offer participants the opportunity to integrate and focus on aspects that appeal to them in a fitness program project. This was done in order to determine if such an intervention would affect their perception of their PL understanding. Whitehead (2001), outlines that an affective facet of PL is an individual’s motivation, so as confidence grows, so does their likelihood of adopting a life-long physically active lifestyle (Mandigo et al., 2009; Sport for Life, 2020; Tremblay & Llyod, 2010). The SDT according to Deci and Ryan (2000) supports this idea that, when an individual is taking part in an activity or task on their own accord, they are far more likely to continue and pursue it further and gain more from it which was the voiced intent of several participants in the intervention (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). Through triangulating observations, student reflections and student interviews, it was clear that students felt that their understanding of PL grew and was impacted in a positive way by the design of the unit which follows the consensus of a flipped classroom environment (Bergmann & Sams, 2012; Botella et al., 2021; Ferriz-Valero, 2022; Jeong & González-Gómez, 2016). These results support the notion that offering autonomy to learners demonstrates significantly more interest in understanding PL and the benefits of life-long activity, aligning with Deci and Ryan’s (2000) SDT motivation model. A deeper understanding of PL, according to the qualitative data, resulted in significant levels of interest similar to the findings of Ferriz-Valero et al. (2022) and Botella et al. (2021), and according to participants, this was as a result of the intervention design using an FCM design. Two prominent themes came from the evidence: 1) Motivational factors, and 2) technology facilitated PL.
**Motivational factors.** As the project design was such that students were offered autonomy in the selection of the overall theme and tasks of the project, the qualitative data aligned with the current research that this intervention had a positively correlated relationship between motivation and PL (de Charms, 1968; Deci, 1975; Ulstad et al., 2019). Indicative of research postulating the importance of personal investment from participants, this study followed along that same vein and demonstrated significant impact on the motivation and interest of students with increasing their PL, either specifically or indirectly (Botella et al., 2021).

Participants in this intervention could be separated into two groups, one group of participants intentionally looking for exercises or other elements of the project that directly related to what they were most interested in; while the other group’s interest increased as the intervention progressed with no real inclination to anything in particular. These participants found they became more engaged and motivated by the project as time went on. This outcome was similar to what Ferriz-Valero et al. (2022) found with their research where learners who were intrinsically motivated found that they became more interested in the activity, and those who were less so, demonstrated a decrease in amotivation due to the design of the FCM according to Botella et al. (2021). This was present in this also indicative of extrinsically compared to intrinsically motivated individuals when it comes to their and (Bandura, 1978; Ulstad et al., 2019; Sun et al., 2017) In both cases, students were vested in the project and in-turn, their motivation shifted as the project went on with a positively correlated change to higher levels of intrinsic motivation and a decrease in amotivation of all participants (Deci & Ryan, 2017). This result is in-line with the body of work done on SDT motivation.
The personal interest of all participants was evident through all of the data sources. This shift towards higher levels of engagement, while learning and in-turn, investing more energy, time and interest in the project was evident to varying degrees. The feedback during the interviews was indicative of this observation as students continually described the intervention as offering them more opportunity to pursue their interests and spend more time learning about them, which is consistent with the FCM (Isaias, 2018; Mazur, 2009; Sookoo-Singh & Boisslle, 2018). Students having the autonomy to determine how they proceeded with their research turned out to be critical in this process. As observed during class time and confirmed in journal responses and interviews, it was clear that despite the diversity of the fitness programs, students fed off of one another increasing their motivation and aiding in the incorporation of conceptual ideas from their peers into their own projects while aligning with the collaborative opportunities within an FCM (Jeong & González-Gómez, 2016; Keller, 2017). The flexibility of the FCM offering autonomy for students in determining when it is best for them to access the material is characteristic of this design (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). Each week of the intervention correlated with observable increases in engagement and motivation of participants to varying degrees. This is to say that given the parameters of the project, students became more vested in the project as the intervention went on which correlates with the “self-determined” profile (Sun et al., 2017). This was particularly evident during the summative assessment presentations. Students were able to describe with a high level of understanding the various aspects of their projects. They spoke with confidence and answered questions in a knowledgeable way, all of which are indicative of a vested effort put forth, as found in
similar research (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). The data collected from this intervention offers evidence that there are no real significant departures from what is typically found in the body of research in this area (Jeong & González-Gómez, 2016; Keller, 2017). The project findings presented themselves to higher levels of motivation with meaningful growth and understanding of PL, and overall wellbeing.

Through the qualitative data sources, it was clear that the effects of the intervention generally aligned with the findings of similar studies where positive correlations indicated the development of PL as motivation shifted. There were some exceptions however, where the participants remained neutral without clear movement towards a positive or negative impact from the intervention, or what could be considered to fall on the amotivation side of the spectrum (Botella et al., 2021; Ferriz-Valero et al., 2022). This was a rare finding; however, it was important to note.

**Technology Facilitated Physical Literacy.** This intervention utilized an FCM framework which offered students the opportunity to engage in learning about PL using a design that is not typical for traditional PE classes (Mandigo et al., 2009; Sport for Life, 2020; Tremblay & Llyod, 2010). As this intervention was designed around the integration of technology, one of the intended outcomes was to measure the changes that the integration of technology had on learning and understanding. Through the analysis of the qualitative data, patterns began to emerge. The result of this intervention’s initiative, through triangulating the three data sources, offered insight to how this approach proved beneficial for this type of project similar to what Botella et al. (2021) and Ferriz-Valero et al. (2022) found in their research. As described by students in their journal responses, a
common perception was that the FCM offered students time to process and come to class with clear expectations or questions in mind, a common element of the FCM (Bergmann & Sams, 2012; Clark et al., 2016; Long et al., 2017; Schrlau, et al., 2016). During class time, students would seek out clarifications to increase their understanding of the task (Batastini, et al., 2018; Bishop & Verlager, 2013; Clark, et al., 2016; Mok, 2014; Schrlau, et al., 2016). Students would frequently check with peers or the teacher to see that they were doing things according to the parameters of the project. This process led to deeper inquiry from participants to understand why their classmates would approach or interpret tasks differently, which is similar to other studies using this model (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017).

The FCM design of the project followed that of other studies, with the exception that the subject area was PE. What this meant was that the step-by-step process of chunking and scaffolding facilitated a deeper understanding of PL (Batastini, et al., 2018; Bishop & Verlager, 2013; Clark et al., 2016; Mok, 2014; Schrlau et al., 2016). Utilizing the FCM offered students time to process the task desired outcomes before they came to class (Tucker et al., 2016). The integration of technology assisted students considerably in the gathering of information and resources as noted in the interview process. The result of this is a more effective and efficient use of class time that students according to the research (Isaias, 2018; Mazur, 2009; Sookoo-Singh & Boissile, 2018). The time saved from not having to go to the school library and simply researching from the class, facilitated a more in-depth examination of the entire scope of the project as well as the specific components in it, generally regarded as a product of the FCM (Roehl et al., 2013). This expedited the process of research in one respect, and supported a deeper
investigation into the specific projects as noted in the journal responses and interviews. As Roehl et al. (2013) highlighted, the relative ease in which students could access information coupled with the FCM considerably enhanced the level in to which students invested themselves into the project.

Technology integration was beneficial for access to information as well as a wide assortment of different types of sources, an important facet of the intervention in developing PL (Roehl et al., 2013). Students were able to find resources in a variety of formats such as videos or images with text, all of which provided them with clear ideas of what they were investigating. Throughout the observations, it was apparent that students were engaging in the learning process and through interviewing participants, it was clearly stated by them that technology was facilitating a more in-depth examination into their area of interest, which in turn led to increased learning.

Ensuring that participants felt their time was being effectively used was an important aspect of keeping students engaged as identified in the research (Bergmann & Sams, 2009; Clark et al., 2016; Enfield, 2013; Schmidt & Ralph, 2016). This feeling held by learners shifted their motivation and increased the level of participation. These factors led to participants increasing their PL as well as their perceptions of it (Ferriz-Valero et al., 2022). Creating content videos for the pre-lesson material followed the typical FCM and enabled students to prepare and come to class with clarifying questions and ideas for their projects (Gilboy et al., 2015; Glance et al., 2018; Tucker et al., 2016). While exploring the various resources, technology proved invaluable in the context of understanding. When presented with ease of access, an abundance of resources with
clearly explained directions, it was clear that participants’ experiences presented a more meaningful and deeper understanding of PL, aligning with the research.

In order to ensure that learners were set up for success, strong pedagogical practice creating a well-defined set of learning outcomes, as well as clearly stated parameters, ensured that meaningful learning was taking place. This was imperative throughout the intervention in order to ensure that participants were engaged with their PL development. Participants felt that the outcomes were clear and with a scaffolded approach, each task was manageable and progressed them toward their end goal without leaving them with the sense of being overwhelmed by any one aspect of the project. Bergmann and Sams (2012), Enfield (2013) and Roehling et al. (2017) discuss the importance of creating differentiation for learners which is inherent in the FCM design.

The FCM for this intervention design created noticeable results in task completion and understanding, predominantly due to the autonomy offered to participants (Bergmann & Sams, 2012; Clark et al., 2016; Long et al., 2017; Schrlau, et al., 2016). In the initial journal response, participants were finding their way and understanding the scope of the project. By the time journal response two was collected, it was clear that participants were fully understanding their objectives with the tasks, specifically highlighting instructional aspects of the design. The intervention following the FCM design enabled participants to determine their own routine to engage the material in a manner fitting to their needs (Bergmann & Sams, 2012; Clark et al., 2016; Long et al., 2017; Schrlau, et al., 2016). This meant that students not only were learning the material, they were also developing study skills and strong learning habits developed through this type of design. The practical benefits of this model were on display with learning taking place outside of
the classroom on the terms of the individual, and during class time, the teacher took on the role of the expert and assisted each individual by addressing their specific needs to further their understanding of PL (Bergmann & Sams, 2009; Al-Sudais, 2019). Face-to-face time with the teacher is more effectively used and facilitates a more tailored learning experience for each participant evident in the data.

As the aim of the project was to demonstrate the benefits of a total fitness program engaging all aspects of physical wellbeing from nutrition to rest and exercise, it was important to create an experience that targeted these components in a personalized way as this increased the likelihood of a shift towards an increase in motivation towards PL according to the body of research (Gomez-Lanier, 2018; Kay et al., 2019; Sookoo-Singh & Boisselle, 2018). Even though it is hard to differentiate the results of the quantitative data from traditional design to the FCM, the qualitative data points, as Ferriz-Valero et al. (2022) determine show an increase in motivation and engagement, which in turn will lead to more physically literate individuals. Effective design offering each participant autonomy ensured participant interest in the learning outcomes, and these outcomes were evident as expressed by students in the journal response data. The FCM design had an inherent personal connection for students, according to other studies, these connections shift the motivation and engagement of students to be more engaged and gain a deeper understanding of, in this case, PL (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). This was an effective way to motivate individuals who might not necessarily engage in physical activities, but given that it was on their own accord, they were able to find ways in which to be physically active that suited their personal needs. As there was a collaborative component to the project with sharing
opportunities occurring during class times both informally and formally, participants benefited from sharing their ideas and learning from others, which was common amongst other research in the area (Jeong & González-Gómez, 2016; Keller, 2017). As ideas were shared, the atmosphere of the class was positive and supportive, again, in-line with what Jeong and González-Gómez’s (2016) findings. This level of engagement facilitated students’ deeper understanding of the importance of being physically literate.

Throughout this intervention, students were given clear instructions, tasks and deadlines, all of which were clearly communicated in the FCM design of the project and followed the three-step framework of an FCM (Gilboy et al., 2015; Glance et al., 2018; Tucker et al., 2016). Students followed the structure and when they had any questions, they came to class asking for clarification, typical of this format (Batastini, et al., 2018; Bishop & Verlager, 2013; Clark, et al., 2016; Mok, 2014; Schrlau, et al., 2016). This meant that students knew what was being asked and what the purpose was. As students came to class knowing that any questions they might have would be addressed, this reduced any potential stress that they might encounter with the demands of the project.

The body of research, according to Gilboy et al. (2015), Glance et al. (2018) and Tucker et al. (2016), indicate that collaborative opportunities facilitate sharing their ideas and exposing them to other potentially impacting ones. These opportunities certainly affected how participants grew their understanding (Jeong & González-Gómez, 2016). Given the overall success of the final assessment, it was clear the efficacy that this aspect of the intervention had in developing the learning and understanding of the students.

In order to increase levels of engagement of participants in this intervention, there were several strategies put into place in all three facets of the FCM intervention (Gilboy
et al., 2015; Glance et al., 2018; Tucker et al., 2016). Offering autonomy within project
parameters (Deci & Ryan, 2017), creating formal and informal collaborative
opportunities (Jeong & González-Gómez, 2016), creating a project design that compels
learners to access and design a fitness program that addresses their own needs primarily
and then grow it into something that others can sample and try were all aspects
incorporated into the intervention to act as an impetus to engage students in the pursuit of
higher levels of PL. Somewhat similar strategies were applied, although a different
context and more specific in nature, to other PE studies (Botella et al., 2021; Ferriz-
Valero et al., 2022). As seen in these studies, the qualitative data here indicates that this
intervention found similar outcomes.

This project was designed to address multiple components of a physically active
lifestyle and develop the PL of participants as designed in FCM models and PE units in
other studies according to the literature (Botella et al., 2021; Ferriz-Valero et al., 2022;
Gilboy et al., 2015; Glance et al., 2018; Tucker et al., 2016). This was clearly outlined
from the start and further iterated to ensure understanding and that the intervention
process was as clear as possible. The summative assessment used in the intervention,
coupled with the qualitative data sources left little doubt that students understood the full
scope of the project, and benefited from the efficacy of the FCM design.

As the design of the intervention was based around previously acquired
knowledge in combination with the specific interests of the individual, the likelihood of
utilizing what has been learned and applying it to the context of this intervention
according to research in the transdisciplinary area (Quigley et al., 2017). Examples from
other subject areas were the connections to good nutrition, the importance of rest as well as differentiation built-in to their programs, was evident.

Throughout the intervention students continuously found themselves learning more about the concept of PL through the FCM design and implementation. Following the “LEE model” and various other three-step models as frameworks, it was typical for students to have a more engaged and active experience that is typical of this general format (Gilboy et al., 2015; Glance et al., 2018; Tucker et al., 2016). Students already had a high level of interest in PL, and given that following this framework, the participants became active learners versus passive ones generally noted in a more traditional model (Ferriz-Valero, 2022; Petress, 2008; Swiderski, 2011). The change in motivation positively correlated with an increase in interest, engagement and knowledge of PL.

Technology was instrumental in the development of each participant’s PL by facilitating the ease of access to so many different resources similarly found in other FCM curriculum (Roehl et al., 2013). Exposure to nutrition plans, rest and workout programs meant that students could take what had already been done and determine ways to apply them to their own circumstance. This autonomy to offer differentiated approaches through the FCM offered students the possibility to go well beyond the parameters and scope of the intervention in many cases, to integrate already tested programs modified to their own needs (Bergmann & Sams, 2012, Enfield, 2013; Roehling et al., 2017). As students developed their programs, they took the time during collaborative opportunities in class to share their findings. Through this exchange, many students were able to look at their programs in various ways that enabled them to improve what they had accomplished (Jeong & González-Gómez, 2016; Keller, 2017).
This collaborative process demonstrated itself to be helpful for students and aided in further impacting PL development.

Given the scope and parameters of the fitness program project, the intention of it was to measure the change in PL from pre- to post-intervention. Based on the data collected, there were no significant changes when the pre- and post-intervention questionnaire were analyzed; this was also the case in the body of literature, which indicated these same findings (Ferriz-Valero, 2022). That is, quantitatively there was no significant change over the course of the intervention from the pre- to post-intervention questionnaires. This is however counter to the observable changes that are noted in the qualitative data of this intervention as well as Ferriz-Valero et al.’s (2022) findings when it came to the observable increase in motivation towards the tasks that students were taking part in. Designing a curriculum where students are offered a high level of autonomy enabled learners to not only access information, but to gain a deeper understanding of what interested them, and thus increasing the likelihood of pursuing a healthy lifestyle after the intervention and continuing to develop their PL (Ferriz-Valero et al., 2022; de Charms, 1968; Deci, 1975; Ulstad et al., 2019). The Ferriz-Valero et al. (2022) findings support this notion of shifting participants’ motivation to be more motivated and in turn more likely to continue on with their PL development.

For many, this intervention marked a turning point in participants’ approach to their own physical wellbeing. As PL was examined in much more depth than most participants had previously done in the past, there was a deeper understanding in its importance. This understanding combined with the projects scope was seen as the impetus for students to pursue a more physically active lifestyle. Due to the efforts put
into the project, for many this meant that they now have a more measured and knowledgeable perspective of their PL and where they want to go with their PA. For this, it should be acknowledged that students’ perceptions saw an increase in their PL.

**Implications**

Understanding the balance that faces learners today between falling victim to a sedentary lifestyle trapped behind a screen to being overwhelmed with the abundance of technology at our disposal, it is important to understand the role that we play in determining if that technology can be put to good use and used as a tool to help students engage and feel empowered to become more physically literate. This study offers a gateway to several significant implications under the auspices of: 1) Personal implications, and 2) future research implications.

**Personal Implications**

Through conducting this action research, I have been able to benefit from this role as a researcher and gain valuable insight into my pedagogical practices. The field of education is fluid and full of continual change. Reflecting on my intervention, lessons and curriculum, I have found myself continuing to change and look to continuing to improve my practice as an educator. Starting this program as a middle school PE teacher, I am now ending it in a new role as a high school social studies teacher. Despite my change in roles, I have been working closely with colleagues, and as my field of focus had a lot to do with various other aspects of educational practices such as motivation and design, I have transferred these skills to develop technology integrated, FCM curriculum units for this new subject area, while taking on other roles to do with learner competencies in order to continue my growth as an educator. In order to continue on this
path, there are three implications that as a teaching practitioner, I aim to focus my energies on. These implications are: 1) Addressing problems as scholarly practitioners, 2) designing student centered curriculum tailored to the needs of the learners, and 3) cultural shift from extrinsically to intrinsically motivated learning.

**Addressing problems as a scholarly practitioner.** When I began my role as a PE teacher over a decade and a half ago, I was an experienced coach and a developed athlete. This led me to believe in a certain way to teach and content delivery. As I began to work with younger learners, I soon realized that my methods and practices were benefiting only the students who were “good” at sports. This became an area where I felt that with development of my own pedagogical foundations and understanding, I could make dramatic changes that would enhance my practice and enhance my teaching environment to suit the needs of all students engaged in PA. I began immersing myself in the current best practices, learning new strategies and techniques and all the while applying them to my situations. This resulted in higher levels of engagement by students and more interest in being physically active.

As the years have progressed, and the initiatives have developed, I decided that it was important to see if my methodologies served a measurable purpose, or would the outcomes remain the same regardless of the design of the curriculum to a certain extent. Reading through the literature and utilizing my expertise in educational technologies, I combined the two to create an FCM curriculum unit in order to measure the changes in motivation and PL of participants and determine if this type of delivery made a measurable difference in their learning and understanding. The interesting outcome was that the quantitative data exhibited no significant changes, whereas the qualitative data
revealed significant results. In examining these findings through the lens of a researcher, it was clear that there were rational explanations as to why there were such differences between the two data sets; time and duration, both of which will be described in the following *implications for future research* section. That being the case, the qualitative data demonstrated the impact that the intervention had in an observable way, while the quantitative data needed more time between the pre- and post-intervention questionnaires in order to mark a significant change.

By looking to the data, a measured and supported approach to PE is now guiding my practice in an informed way, beneficial to learners and can be shared with colleagues in an effort to create a more sustained and effective curriculum that encourages PL growth and life-long participation in PA.

**Designing student centered curriculum tailored to the needs of the learners.**

The purpose for teachers conducting action research is to improve their practice and methods by collecting information from particular learning environments (Mertler, 2017). In order to improve upon my teaching methods, I felt it necessary to first consider a problem of practice. Given my field and background, motivation and PL were two areas of interest. Those coupled with a background in applications of educational technology and instructional strategies in curriculum delivery offered me an opportunity to take a new approach to PE and wellbeing. Throughout the process, it became clear that a thoughtful approach to PL and the promotion of being more active would not only educate learners about best practices, it would lead to them having more of an interest in their own physical wellbeing through design. Creating a project that addressed all of these needs was challenging, however, guided by the literature, the tailored design of the
curriculum unit took shape. Addressing the needs of the learners and doing so in an individualized manner, enabled each project to follow a set of parameters, yet still speak to the specific interest of each participant.

Through the qualitative data collected in this intervention, it was apparent that this method of learning and immersion was beneficial to the experience and buy-in of each participant. Creating an opportunity to learn and gain a deeper understanding of a concept was the objective and when measured, it became clear that this type of initiative merits further research and an opportunity to shift the focus of PE from simply learning a sport, to understanding what the benefits of being physically active are, and thus creating a deeper understanding of PL.

**Cultural shift from extrinsically to intrinsically motivated learning.** One of the challenges that is faced when it comes to students and their motivation within the context of international schools, is the value of the grade and that being the driving force in finding success. The ability to measure one’s own success compared to others. Several years prior to the intervention, the middle school decided to shift to standards-based grading practices. This process was meant with challenges and the main being this idea that there are no grades awarded in standards based. This is true to some degree, as success is earned and demarcated by the teacher determining if the student has mastered the assessed skill or not. This was a major cultural shift in the school, and with extended efforts and practice, the culture did shift towards being motivated by the process of learning rather than the grade attached. This study intended to take this further and shift the perception of students towards the recognition that PL and motivation towards it, given the right methodological approach could shift participants on the motivation
spectrum towards a more intrinsically motivated engagement. As noted in the qualitative data, this turned out to shift motivation in a positive way towards intrinsically motivated participants. What this shift meant was there was a distinct shift in the culture of the school towards PL and being more physically active. This shift was enough to merit further examination into the effectiveness that a technology integrated, FCM unit acted as the impetus to explore more in this field and continue to shift the school culture beyond the desire for a grade and rather the benefit in the learning.

Implications for Future Research

The findings from this research indicate that there is a need to further explore the development of PL amongst younger learners by utilizing an FCM model with the integration of technology and cross-curricular initiatives. As behaviors and habits are formed at a young age, this is an incredibly important time to educate learners on the importance of being physically active. Given the outcomes of this intervention, it is apparent that school culture plays a role in the perceptions of individuals and how they intend to pursue their development of PL, and it should be noted that pedagogical practices such as the FCM are important components to integrate into learning as we determine adaptations to our teaching practices as to best meet the needs of future learners. In order to do so, there are several areas to look to for future implications, they are: 1) Timing of the unit, 2) support and professional development for teachers, and 3) a longitudinal study looking to growth and understanding.

Timing of the unit. The timing in this intervention enabled this novel study to begin investigating the impact that this type of intervention would have on learners’ motivation as well as their PL. There were two key components that could be modified in
order to have a greater impact on student learning: 1) Timing of the intervention, and 2) duration of the intervention.

**Timing of the intervention.** The initial intent of this intervention was to have it take place during the spring of the previous year, however due to Covid and the obstacles that came from it, this was pushed to the fall of the following year. The rationale of having the intervention in the spring is that it offers more time to prepare students with routine and background understanding to embark on the project’s tasks while having a certain level of understanding. As the school has a fair amount of turnover each year, it cannot be guaranteed that all students will have this prior knowledge going into a new school year. Keeping this in mind, investigating such an intervention at the end of the school year may merit more significant results in the data and its findings.

**Duration of the intervention.** The duration of the intervention was such that the number of classes spent on the project was suitable to fulfill the parameters of the project. Where there were identifiable areas where there could be improvement was not having the project timeline fall with a break right in the middle of it. Students having a set amount of time in consecutive weeks, without any vacation breaks would offer more focus to the project. In passing, students did mention that they felt the week-long break broke their momentum. Distributing the project over a longer course of time with the allocation of one day a week of class time specifically set aside to work on the project would also be another area worthwhile investigating.

**More time between pre- and post-intervention questionnaires.** Along with the timing and duration of the intervention, the findings from the pre- and post-intervention questionnaire were that there were no real significant changes. In the future, having
students do both of the pre- and post-intervention questionnaires at the start and towards the end of the year respectively, would provide data that highlights if there were any changes of significance with more time to learn and understand between. These questionnaires spread further apart would inherently present more accurate data than that over the course of a shorter period of time. Mainly this is due to the time that it takes for an individual to see physiological changes through exercise and fitness as well as time for cognitive changes to occur with shifts in motivation to take place. This would allow participants to observe and process changes within themselves.

**Support and professional development for teachers.** In order to facilitate cognitive and physiological shifts in learners, educators need to be given the tools to do so, as well as the understanding on how to effectively implement them. This type of initiative needs investment by the institution in order to find success in the endeavor. In order to achieve efficacy in this, there are two facets of the initiative that need to be addressed: 1) Extensive and ongoing professional development, and 2) allocating time for teacher planning.

**Extensive and ongoing professional development.** It goes without saying that investment in any initiative is critical to ensure its success. Increasing levels of knowledge and shifting student motivation towards a more intrinsically oriented, learning focused mindset takes understanding and investment. Effectively using a technology integrated the FCM is another area where educators need to be well versed on the design and implementation of such a framework. Without long-term and in-depth professional development, educators will find this type of initiative challenging and possibly frustrating, which in turn will likely lead to failure. To avoid this outcome, there needs
proper time and resources invested in order to facilitate the efficacy of this type of initiative (Ertmer, 1999). Resources and consistent time provided are necessary to ensure that teachers have a conceptual understanding, as well as a working knowledge of the integration of technology to ensure the efficacy of an FCM design.

Allocating time for teacher planning. As is the case for any initiative to be successful, the allocation of sufficient planning time needs to be a priority in order to create buy-in from teachers, and later, successful application of the framework. Without this time, the likelihood of success is low. Providing specific time focused on the efficacy of the initiative is vital for a successful outcome and without it, a perception of time and resources wasted is the likely outcome.

Longitudinal study looking to growth and understanding. A longitudinal study measuring growth and change across middle school years. Changes in motivation and understanding of PL are measures that, as this study identified, are areas in which over the course of a relatively short intervention, results are somewhat tempered. A longitudinal study that follows students across their middle school tenure would offer more insight into their growth and create more accurate data to measure any changes in motivation as well as offer insight into the development of their PL. As this was a technology integrated intervention, the data is easily transferred and kept safe, year-to-year as an added benefit.

As the CAPL-2 includes measurement adjusted and appropriate age brackets. Measuring these possible changes could be integrated into a study that takes a project similar to the one presented in this intervention that develops age-appropriate iterations in each of the four years of middle school. The data provided here would offer more insight
into the effectiveness of the intervention when it comes to measuring changes in a student’s PL.

The MSLQ is another instrument that could be modified in order to be more age appropriate for the aforementioned longitudinal study. Presenting students with this type of questionnaire at the start and again towards the end of the year would provide data that would offer greater insight into the changes of motivation that students see over the course of their middle school years. Measuring this data would enable educators to formulate better strategies to introduce a curriculum that is better suited to the needs of all learners based on data provided.

In combination with the intervention, these two pre- and post-questionnaires would provide deeper insight and understanding to a PE program through cognitive and physical recognition of where an individual lies on the spectrum of understanding and confidence. Any data that provides this type of information over such an extended period would be invaluable in tailoring a program to suit the needs of all learners.

**Limitations**

As all research has its shortcomings, it should be recognized that this study was no exception. One aspect of this study that needs to be acknowledged are the effects that the Covid 19 pandemic had on the face-to-face interactions of the sample group as well as the overall parameters of how the intervention took place. Social distancing, possible closures limiting face-to-face time with students, were looming throughout the intervention and a sense of uncertainty was ever prevailing. The pandemic had a larger than expected impact on the cross-curricular component of the intervention as curriculum plans were not adhered to in the same way that they had previously. This in the end was
an aspect where further exploration is certainly needed in more typical circumstances. The pandemic aside, this study had other limitations of note: a) methodological limitations, b) limitations associated with the findings, and c) researcher limitations.

**Methodological Limitations**

Action research inherently contains some limitations, and this study maintains this. The methodological design of this study aimed partly to measure the motivational changes amongst 13-year-olds through the use of a reliable instrument, the MSLQ. The application of this instrument as a pre- and post-intervention questionnaire for this age group was novel. It became clear with several factors impinging on the data collected from this instrument, that there were certain limitations which were evident. Using the MSLQ as a pre- and post-intervention questionnaire aimed at measuring the change in participants motivation over the course of the intervention demonstrated itself to serve its purpose, however, as there were only 8 weeks between the pre- and post-intervention questionnaires completed by students, the data provided did not demonstrate any significant change due to what might be considered too short a time for there to be noticeable differences. This is an area where further examination would provide more information as to the effectiveness of the instrument for this age group. Given more time for the intervention, such as a year or over the course of their entire time in middle school centered around such initiatives, would create more reliable data to record any changes in motivation that might occur.

Another limitation was the limited timeframe of this intervention. This is in part due to the amount of time needed to actually observe any significant changes in practice and understanding from the student perspective (Ottenbreit-Leftwich et al., 2010). A
longer period of time combined with a larger sample size would offer more insight into
the findings of this intervention; as a small sample size may affect the variation and
reliability in the data collected (Radecki, 2009). As the sample size was somewhat
limited to 31 participants, results may not communicate to a broader generalizability
amongst all international middle schools, this is typical for action research. A larger
sample size carried out over the course of several years would offer more data and help in
determining the value of the intervention (Fraenkel et al., 2015). However, it still remains
that the data collected in this study was particular to its specific context, participants and
setting which denotes the challenges in generalizability (Mertler, 2016).

Having an increased sample size would offer more data consisting of reliable
evidence supporting whether there was a significant change in motivation towards PL in
this type of intervention, or to what degree. Investigating the change in motivation in
future iterations would likely see more variation in the data by increasing the sample size
and continuing the intervention for a longer duration. These two factors would help
determine the effectiveness of the instrument (MSLQ) in this context.

**Limitations Associated with Findings**

This action research study aimed to examine if there were any changes in the level
of motivation and understanding of PL through the design of the intervention and the
instruments used. Quantitative data was collected from a pre- and post-intervention
questionnaire. The CAPL-2 was used to measure the PL of students and given the limited
time of the intervention, may not have reflected enough time for significant changes to
take place for the data to show any real changes. A longer period of time after the
intervention to again measure the changes would have offered further insight to the
development of PL amongst the participants in order to determine sustained, decreased or increased levels of PL.

The MSLQ was used in this study to measure changes in student motivation towards PL, and given the time of the intervention, changes may not have had enough time to show any significant changes. In that case, the data would be more reliable given more time in between the pre- and post-intervention questionnaire. Offering the pre- and post-intervention questionnaires with a longer period between them would offer time for the patterns and behaviors of participants to develop more, offering further insight to the long-term changes in motivation towards PL. While the quantitative data identified changes from pre- to post-intervention, the qualitative data had different limitations to address.

The qualitative data was collected through interviews, observations and journal reflections. In any case, there are opportunities for students to have inaccuracies in their journal responses when information is self-reported (Duncan et al., 2012). Such events may have taken place during the interviews, where students may have felt that they needed to give a specific answer. Another possibility was during the course of the observations, participants may have altered their behavior knowing that they were being observed. In order to limit these possible inaccuracies, triangulation of the data collected from the reflections, interviews and observations was made in order to provide more reliable findings.

**Researcher Limitations**

Ultimately, as the researcher, there is the potential that I may have contributed to additional limitations throughout the course of the study. My own assumptions and biases
may have influenced the outcomes during the observation data collection and analysis process (Rives, 2005; Seid, 2017). Triangulation through the use of journal responses and interviews enabled all aspects of the study, negative and positive, to come to light and be reflected in the analysis process, which acts as a counter to biases prevalence in any one facet of the intervention (Creswell, 2017). Furthermore, adding measures of confidentiality and anonymity to the intervention to aid students in more open and honest responses, still may have affected their willingness to respond to journal prompts and interview questions. Being a participant observer may have influenced their behavior during the observation process. However, given that the observation process was consistent with a typical class, students did not have any reason for this to overtly influence their behavior.
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### APPENDIX A

**CAPL-2 AND MSLQ QUESTIONNAIRES**

#### CAPL-2

<table>
<thead>
<tr>
<th>Some kids don’t like playing active games</th>
<th><strong>BUT</strong></th>
<th>Other kids really like playing active games</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Really true for me</td>
<td>[ ] Sort of true for me</td>
<td>[ ] Really true for me</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Some kids are good at active games</th>
<th><strong>BUT</strong></th>
<th>Other kids find active games hard to play</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Really true for me</td>
<td>[ ] Sort of true for me</td>
<td>[ ] Really true for me</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Some kids don’t have much fun playing</th>
<th><strong>BUT</strong></th>
<th>Other kids have a good time playing sports</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Really true for me</td>
<td>[ ] Sort of true for me</td>
<td>[ ] Really true for me</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Some kids do well in most sports</th>
<th><strong>BUT</strong></th>
<th>Other kids feel they aren’t good at sports</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Really true for me</td>
<td>[ ] Sort of true for me</td>
<td>[ ] Really true for me</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Some kids don’t like playing sports</th>
<th><strong>BUT</strong></th>
<th>Other kids really enjoy playing sports</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Really true for me</td>
<td>[ ] Sort of true for me</td>
<td>[ ] Really true for me</td>
</tr>
</tbody>
</table>
Some kids learn to play active games easily, but other kids find it hard learning to play active games.

Thank you for telling us which kids are most like you!

Why are you active?
Boys and girls can be active by doing all sorts of things:

- Exercise (walking, keeping fit, or gym class)
- Playing outside or doing active things (like playing in the park)
- Sports (like soccer, tennis, hockey, dance or swimming)

Below are some reasons why you might be active. Please read each sentence and tell us how true it is for you.

I am active because…

<table>
<thead>
<tr>
<th>Reason</th>
<th>Not true for me</th>
<th>Not really true for me</th>
<th>Sometimes true for me</th>
<th>Often true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being active is fun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy being active</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like being active</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How do you feel about being active?

The next section has some sentences describing how girls and boys feel about BEING ACTIVE and DOING ACTIVE THINGS (like active games, playing outside and doing sports).

Please read each sentence and tell us how much each sentence is like you.

I am active because…

<table>
<thead>
<tr>
<th>Reason</th>
<th>Not me at all</th>
<th>Not really like me</th>
<th>Sometimes like me</th>
<th>Quite a lot like me</th>
<th>Really like me</th>
</tr>
</thead>
<tbody>
<tr>
<td>When it comes to playing active games, I think I am pretty good.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I think I do well at activities compared to other children.

When it comes to being active, I have good skills.

<table>
<thead>
<tr>
<th>What do you know about physical activity?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Please circle only one answer for each question</strong></td>
</tr>
</tbody>
</table>

1. How many minutes each day should you and other children do physical activities that make your heart beat faster and make you breathe faster, like walking fast or running? Count the time you should be active at school and also when you are at home or in your neighborhood.

   a) 20 minutes  
   b) 30 minutes  
   c) 60 minutes or 1 hour  
   d) 120 minutes or 2 hours

2. There are many different kinds of fitness. One type is called endurance fitness, or aerobic fitness, or cardiorespiratory fitness. Cardiorespiratory fitness means:

   a) How well the muscles can push, pull, or stretch  
   b) How well the heart can pump blood and the lungs can provide oxygen  
   c) Having a healthy weight for our height  
   d) Our ability to do sports that we like

3. Muscular strength or muscular endurance means:

   a) How well the muscles can push, pull, or stretch  
   b) How well the heart can pump blood and the lungs can provide oxygen  
   c) Having a healthy weight for our height  
   d) Our ability to do sports that we like

4. If you wanted to GET BETTER AT A SPORT SKILL (like kicking and catching a ball), what would be the best thing to do?

   a) Read a book about kicking and catching a ball  
   b) Wait until you get older  
   c) Try exercising or being more active  
   d) Watch a video, take a lesson, or have a coach teach you how to kick and catch
5. This story about Sally is missing some words. Choose from the words in the box to fill in the missing words in the story. Each word can only be used to fill one blank space in the story. There are more words than blank spaces, so not all words will be used.

<table>
<thead>
<tr>
<th>Fun</th>
<th>Pulse</th>
<th>Strength</th>
<th>Bad</th>
<th>Breathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>Endurance</td>
<td>Good</td>
<td>Sport</td>
<td>Stretches</td>
</tr>
</tbody>
</table>

Sally tries to be active every day. Running every day is good for her heart and her lungs. Sally thinks that physical activity is _____ and is also _____.

her sport team’s practice she does more running to improve her _____.

team also does exercises like push-ups and sit-ups that increase her _____.

When cooling down, she _____ to improve her flexibility and slow her heart rate. After exercising, she checks her heart rate which is also called a _____.

6. During the past week (7 days), on how many days were you physically active for a total of at least 60 minutes per day? Count all of the time you spent doing activities that increase your heart rate or made you breathe hard.

<table>
<thead>
<tr>
<th>I was active for</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>days</th>
</tr>
</thead>
</table>

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MSLQ Part A

1. In a class like this, I prefer course material that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I will be able to learn the material in this course.
3. When I deliver a presentation, I think about how poorly I am doing compared with other students.
4. I think I will be able to use what I learn in this course in other courses.
5. I believe I will receive an excellent grade in this class.
6. I'm certain I can understand the most difficult material presented in the readings for this course.
7. Getting a good grade in this class is the most satisfying thing for me right now.
8. When I deliver a presentation, I think about items in other parts of the presentation I can't explain well.
9. It is my own fault if I don't learn the material in this course.
10. It is important for me to learn the course material in this class.
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
12. I'm confident I can learn the basic concepts taught in this course.
13. If I can, I want to get better grades in this class than most of the other students.
14. When I deliver a presentation, I think of the consequences of failing.
15. I'm confident I can understand the most complex material presented by the instructor in this course.
16.  In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.
17.  I am very interested in the content area of this course.
18.  If I try hard enough, then I will understand the course material.
19.  I have an uneasy, upset feeling when I deliver a presentation.
20.  I'm confident I can do an excellent job on the assignment and presentation in this course.
21.  I expect to do well in this class.
22.  The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
23.  I think the course material in this class is useful for me to learn.
24.  When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.
25.  If I don't understand the course material, it is because I didn't try hard enough.
26.  I like the subject matter of this course.
27.  Understanding the subject matter of this course is very important to me.
28.  I feel my heart beating fast when I deliver a presentation.
29.  I'm certain I can master the skills being taught in this class.
30.  I want to do well in this class because it is important to show my ability to my family, friends, employer (delete), or others.
31.  Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.
Dear participant,

My name is Euan Frew. I am a doctoral candidate in the Education Department at the University of South Carolina. I am conducting a research study as part of the requirements of my degree in Curriculum and Instruction, and I would like to invite you to participate. This study is sponsored by The University of South Carolina.

I am evaluating the implementation of a flipped classroom, technology integrated, physical education unit, enhanced with STEAM to measure the change in eighth-grade students’ physical literacy knowledge. If you decide to participate, you will be asked to conduct meetings with me for an interview about your experiences with the flipped classroom, technology integrated, physical education unit, enhanced with STEAM, to complete some questionnaires about your motivation and understanding of physical literacy and write reflections on journal prompts related to your experiences throughout the intervention.

In particular, you will be asked questions about your thoughts on the PE unit, your motivation to learn physical literacy and has your physical literacy knowledge changed. If you feel uncomfortable answering some of the questions you do not have to answer any questions that you do not wish to answer. The meeting will take place at a mutually agreed upon time and place, and should last about 15 minutes. The interview will be audio videotaped so that I can accurately transcribe what is discussed. The tapes will only be reviewed by members of the research team and destroyed upon completion of the study.

Participation is confidential. Study information will be kept in a secure location at The American School of The Hague. The results of the study may be published or presented at professional meetings, but your identity will not be revealed.

I will be happy to answer any questions you have about the study. You may contact me at efrew@ash.nl or efrew@email.sc.edu.

Thank you for your consideration. Please contact me at the email address below if for whatever reason you are not wanting to or unable to participate in this study. Otherwise please sign below to give assent to participation in this study.

Participant signature: _______________ Guardian signature: _______________

With kind regards,

Euan MS Frew

Mr. Euan Frew

Phone: +31 (0)643965831

Email: efrew@ash.nl

APPENDIX B

LETTER OF ASSENT

Dear participant,

My name is Euan Frew. I am a doctoral candidate in the Education Department at the University of South Carolina. I am conducting a research study as part of the requirements of my degree in Curriculum and Instruction, and I would like to invite you to participate. This study is sponsored by The University of South Carolina.

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Participant signature: _______________ Guardian signature: _______________

With kind regards,

Euan MS Frew

Mr. Euan Frew

Phone: +31 (0)643965831

Email: efrew@ash.nl
APPENDIX C

IRB APPROVAL LETTER

OFFICE OF RESEARCH COMPLIANCE

UNIVERSITY OF SOUTH CAROLINA

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
APPROVAL LETTER for EXEMPT REVIEW

Re: Pro00105867

Dear Mr. [Redacted],

This is to certify that the research study *An Examination of Physical Literacy: Learning Through a Cross-Curricular, Technology Integrated Approach*, was reviewed in accordance with 45 CFR 46.104(d)(1). The study received an exemption from Human Research Subject Regulations on 11/12/2020. No further action or Institutional Review Board (IRB) oversight is required, as long as the study remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research study could result in a reclassification of the study and further review by the IRB.

Because this study was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

All research related records are to be retained for at least three (3) years after termination of the study.

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact [Redacted].

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager
APPENDIX D

INTERVIEW SCRIPT AND PROTOCOL

Greetings and thank you for being a part of this study. As we start the process, I wanted to thank you for being a part of this action research and reiterate the purpose of it. The objective here is to evaluate the implementation of a technology integrated STEAM physical education unit to increase students’ physical literacy. This interview will try to examine how a cross-curricular PE unit, grounded by the use of technology affects your understanding of physical literacy.

The interview itself will last approximately 15 minutes and is completely voluntary. Feel free to stop the interview at any time without any consequence. Throughout the interview, I will be recording and taking notes to ensure accuracy. Is this okay with you?

If at any time you are not comfortable with the questions or have any issues, please don’t hesitate to ask for clarification. Everything you say is confidential and the information used will be anonymized. I will be asking you a series of questions as well as follow-up questions to further my understanding of your experiences.

Let’s move on to the research questions. The following questions will examine your perceptions of the technology integrated STEAM physical education unit on your physical literacy knowledge:

1. In what ways has technology helped you access resources and information about physical activity? Please explain how it did this.
2. Do you think that technology has changed your understanding of physical literacy?
   Please explain how.

3. In what ways has your motivation changed your engagement in learning about physical literacy in this unit?

4. Do you feel that this PE unit helped to motivate your learning of physical literacy?

5. Please describe the ways in which it did or did not motivate your learning of physical literacy.

Let’s move on to the final research question area about what are your perceptions of the technology integrated STEAM physical education unit on your motivation to learn physical literacy:

6. How effective has the use of technology been in helping you gain a better understanding of physical literacy?

7. How has the use of technology in this unit changed your understanding of physical literacy?

8. How has your understanding of PL changed over this unit?

9. Have you found that technology has motivated you to learn in this unit? In what ways?

10. How do you think your motivation towards learning about physical literacy has changed?

11. With a better understanding of physical literacy, what will be your next steps?

12. Where do you see this change or these changes taking you in regards to your understanding of physical literacy and being more physically active?
Well, that is the end of the interview, thank you for your time and for participating in this process. Just to make sure, you are still in agreement to participate in this study? In case you change your mind here is my contact information, so please let me know if you find that you have any questions and I will be happy to follow up with you. Have a great day!
## APPENDIX E

### OBSERVATION CHECKLIST

**List of Observed Engaged Learning Behaviors**

<table>
<thead>
<tr>
<th>The participant . . .</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–15</td>
</tr>
<tr>
<td>1</td>
<td>Asks questions about workouts, exercises, or on task issues (e.g., &quot;Does anyone have suggestions for HIIT workouts?&quot;, &quot;Which exercises do you find hard/easy to do?&quot;, &quot;Would you like to try it?&quot;, &quot;Did you understand my explanation?&quot;)</td>
</tr>
<tr>
<td>2</td>
<td>Offers <strong>choice</strong> to peers (e.g., choice in the order of the exercises, choice in materials used, choice on which level of difficulty they engage in an exercise)</td>
</tr>
<tr>
<td>3</td>
<td>Takes the opportunity to <strong>experience</strong> problems, to <strong>practice</strong> independently, to <strong>experiment</strong>, to <strong>exercise</strong> and to solve problems on their own, without interfering (e.g., participants engage in exercises without knowing end results).</td>
</tr>
<tr>
<td>4</td>
<td>Offers peers a specific <strong>explanation</strong>, rationale for rules, tasks or exercises (e.g., this is important because . . . , placing one foot in front of the other helps because it will improve your balance). Emphasizing the importance of an exercise is also part of this practice.</td>
</tr>
<tr>
<td>5</td>
<td>Gives an <strong>overview</strong> of the content and structure of their choices (e.g., formulates workout goals, explains how different exercises fit into the entire program.)</td>
</tr>
<tr>
<td>6</td>
<td>Gives clear verbal queues, information and descriptions</td>
</tr>
<tr>
<td>7</td>
<td>Monitors if peers consequently live up to their workload for <strong>collaborative</strong> work.</td>
</tr>
<tr>
<td>8</td>
<td>Uses <strong>variation</strong> between and within exercises</td>
</tr>
<tr>
<td>9</td>
<td>Applies <strong>differentiation</strong> (e.g., provides exercises with a different degree of difficulty, taking into account the possibilities of different abilities).</td>
</tr>
<tr>
<td>10</td>
<td>Offers peers new tips and <strong>advice</strong>.</td>
</tr>
<tr>
<td>11</td>
<td>Offers <strong>positive feedback</strong> (e.g., “great find”, “you explained that well”)</td>
</tr>
<tr>
<td>12</td>
<td>Encourages peers to persist (e.g., “come on, you can do find a good exercise for that”).</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
</tr>
<tr>
<td>13</td>
<td>Acts as a positive <em>role model</em></td>
</tr>
<tr>
<td>14</td>
<td>Offers help during exercise selection and understanding process</td>
</tr>
<tr>
<td>15</td>
<td>Addresses peers respectfully when the opportunity occurs.</td>
</tr>
<tr>
<td>16</td>
<td>Is physically present and a part of the class joining with other participants.</td>
</tr>
<tr>
<td>17</td>
<td>Is enthusiastic and eager</td>
</tr>
<tr>
<td>18</td>
<td>Puts effort and energy into the project.</td>
</tr>
<tr>
<td>19</td>
<td>Takes the perspective of others into account, and demonstrates empathy.</td>
</tr>
<tr>
<td>20</td>
<td>Pays attention to what others are saying and takes feedback well.</td>
</tr>
<tr>
<td>21</td>
<td>Demonstrates the tasks themselves and serves as a “model”.</td>
</tr>
</tbody>
</table>

**Total impression of engaged learning behavior**

Physical setting description:

Other notes:
APPENDIX F

REPORTABLE STANDARDS

Reportable Standards used for the intervention:

<table>
<thead>
<tr>
<th>Standard 2</th>
<th>Completes fitness tasks proficiently, and performs well in standardized tests that evaluate a variety of types of fitness used within physical activities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 3</td>
<td>Concept application. Applies various movement concepts within competitive and non-competitive activities, by learning and refining motor skills through efficient practice and feedback.</td>
</tr>
<tr>
<td>Standard 4</td>
<td>Wellness. Understands the importance of wellness in order to make meaningful decisions that positively impact their health and wellbeing.</td>
</tr>
<tr>
<td>Standard 5</td>
<td>Positive interactions. Implements core values within physical education to ensure positive interactions.</td>
</tr>
</tbody>
</table>
APPENDIX G

UNDERSTANDING AND SCORING THE CAPL-2

Knowledge and Understanding Calculation of the CAPL-2 Questionnaire

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>range</td>
<td>range</td>
<td>range</td>
<td>range</td>
<td>range</td>
</tr>
<tr>
<td>0 to 1</td>
<td>0 to 1</td>
<td>0 to 1</td>
<td>0 to 1</td>
<td>0 to 6</td>
</tr>
</tbody>
</table>

= Knowledge and Understanding domain score (10 points)

Interpreting the Knowledge and Understanding Domain Score

<table>
<thead>
<tr>
<th>Beginning</th>
<th>Progressing</th>
<th>Achieving</th>
<th>Excelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5.6</td>
<td>5.6 to 7.8</td>
<td>7.9 to 8.6</td>
<td>&gt; 8.6</td>
</tr>
</tbody>
</table>

Scoring Predilection Items in the CAPL-2

<table>
<thead>
<tr>
<th></th>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Other kids really like playing active games</th>
<th>Other kids have a good time playing sports</th>
<th>Other kids really enjoy playing sports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some don’t like playing active games</td>
<td>0.6</td>
<td>1.2</td>
<td>2.5</td>
<td>1.8</td>
<td>Other kids really like playing active games</td>
<td>Other kids have a good time playing sports</td>
<td>Other kids really enjoy playing sports</td>
</tr>
<tr>
<td>Some kids don’t have much fun playing sports</td>
<td>0.6</td>
<td>1.2</td>
<td>2.5</td>
<td>1.8</td>
<td>Other kids really like playing active games</td>
<td>Other kids have a good time playing sports</td>
<td>Other kids really enjoy playing sports</td>
</tr>
<tr>
<td>Some kids don’t like playing sports</td>
<td>0.6</td>
<td>1.2</td>
<td>2.5</td>
<td>1.8</td>
<td>Other kids really like playing active games</td>
<td>Other kids have a good time playing sports</td>
<td>Other kids really enjoy playing sports</td>
</tr>
</tbody>
</table>

Total Predilection score (Sum of Questions)

Note. Predilection score for PA is determined based on the response of the three questions.
**Scoring Adequacy Items in the CAPL-2**

<table>
<thead>
<tr>
<th></th>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
<th>Sort of true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some kids are good at active games</td>
<td>2.5</td>
<td>1.8</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Other kids find active games hard to play</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some kids do well in most sports</td>
<td>2.5</td>
<td>1.8</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Other kids feel they aren’t good at sports</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some kids learn to play active games easily</td>
<td>2.5</td>
<td>1.8</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Other kids find it hard learning to play active games.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Adequacy score (Sum of questions)

*Note.* Adequacy score for PA is determined based on the response of the three questions.

**Calculating the Motivation and Confidence Domain Score**

<table>
<thead>
<tr>
<th>Predilection range</th>
<th>Adequacy range</th>
<th>Intrinsic Motivation range</th>
<th>Competence range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8 to 7.5</td>
<td>1.8 to 7.5</td>
<td>1.8 to 7.5</td>
<td>1.5 to 7.5</td>
</tr>
</tbody>
</table>

= Motivation and Confidence domain score (30 points)