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Achievement Goal Fitting

Let's make moving more fun!

R.W.L. (Ruud) Wijffelaars
0890259, June 2018

Master of Science **Human-Technology Interaction**

Where innovation starts

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Eindhoven, June 2018

What is the influence of achievement goal fitting on enjoyment?

by

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In partial fulfilment of the requirements for the degree of

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Preface

Before you lies the thesis titled: *What is the influence of achievement goal fitting on enjoyment?*" which marks the ending of, might I say, an era in my life. After 13 years of studying, this document concludes my journey through the education system. I've had the pleasure to develop practical skills as a Real-time systems engineer. Sparked my creative side as a Communication and Multimedia Designer and now as Human Technology Interaction researcher, I am finishing up by adding academic skills as icing on the cake. Thus concluding my third, and tentatively, final study.

I would like to thank my supervisors: dr. J.R.C. (Jaap) Ham and prof dr. ir. M.M. (Tilde) Bekker for their guidance and support during this process. It was very interesting to see the interplay between both faculties in our weekly meetings. I also wish to thank all the participants and PE teachers, without whose cooperation I would not have been able to conduct this experiment.

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Lastly, I would like to thank the youth members of Scouting Rudyard Kipling Nuenen who participated in my pre-test. Without this pre-test I would merely be doing guesswork. I hope you'll enjoy reading this thesis.

R.W.L. (Ruud) Wijffelaars

Travel is fatal to prejudice, bigotry, and narrow-mindedness, and many of our people need it sorely on these accounts. Broad, wholesome, charitable views of men and things cannot be acquired by vegetating in one little corner of the earth all one's lifetime.
– Mark Twain

Abstract

Decreasing amounts of physical activity under adolescents have become a general concern. One of the breeding grounds for a positive attitude towards physical activity is physical education (PE). Research has proven the positive effects of active participation in PE lessons both immediate as well as on the long term. One of the main goals of PE in the Netherlands is to ensure that students are taught a basis of movement skills as well as to develop competence and enthusiasm to participate in physical activity. To promote this enthusiasm within students, at the very least the student should enjoy the activities provided. Different theories exist which explain motivational influencers for enjoyment in this target group. One of these theories is the achievement goal theory. According to this theory, students are believed to have a dispositional achievement goal orientation (mastery vs performance, approaching vs avoiding) and a subjective experience of the achievement climate (mastery or performance) in which the activity takes place. Whilst several studies have investigated whether a fit of the achievement goal climate to a person's dispositional achievement goal orientation yields positive effects, studies have shown contradicting results so far. We belief this is due to the fact that most studies measure rather than manipulate the climate. Therefore variance between the climates remain minimal. By directly manipulating the climate in either mastery or performance direction we can measure more accurately what the effects are of fitting an achievement goal climate to an achievement goal disposition on enjoyment. Therefore the current study researched: *What is the influence of activating a mastery climate versus a performance climate, and the dispositional achievement goal orientation (mastery to performance) of the participant on the participant's enjoyment of a target behaviour, in the context of PE class exercises.*

Two activities were designed to activate either a performance or a mastery climate during a PE lesson. In both activities students were asked to run laps and step on interactive steps with every passing lap. In the mastery activation these steps gave feedback such that the participant got encouraged to improve their lap time whilst no comparisons were made against other students. In the performance activation these steps gave feedback such that maximal comparison against other participants of the same gender was made. In addition the performance activation offered a real time overview of the ranking amongst participants in that round. The experiment was done in two high schools with students from classes 1 and 2. After running the experiment ($n = 137$) no link was found between enjoyment and activated climate. However, when taking into account the climate assessment of the participant, we found an effect of disposition, moderated by climate assessment on enjoyment in the performance activation. The mastery activation was unsuccessful, which might be due to PE lessons having an overall mastery activating climate. We managed to find an effect of disposition moderated by climate assessment on enjoyment, which seems to imply that fitting an achievement goal climate to the disposition of the participant yields positive effects. However, this effect was only seen in the performance activation. Thus, if future research has similar conclusions, enjoyment of several PE activities might be increased.

Acronyms

AGT	-	Achievement Goal Theory
BCW	-	Behaviour Change Wheel
CI	-	Confidence Interval
COM-B	-	Capability, Opportunity, Motivation - Behaviour
HAVO	-	Higher general continued education
MAp	-	Mastery Approach
NNGB	-	Nederlandse Norm Gezond Bewegen
PA	-	Physical Activity
PAp	-	Performance Approach
PE	-	Physical Education
SD	-	Standard Deviation
SE	-	Standard Error
TNO	-	Netherlands Organisation for Applied Scientific Research
VMBO	-	Preparatory middle-level vocational education
VWO	-	Preparatory scholarly education

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1 Introduction

A recent report by RIVM and CBS (2014) showed that in the passing years declining levels of physical activity have been found amongst children and adolescents in the Netherlands. Several Dutch institutes, such as the Dutch Health Council and the Dutch organisation for Applied Scientific Research (TNO) developed norms to guide and assess the most healthy standard per age group (Gezondheidsraad, 2017; RIVM & CBS, 2014). These norms are for example: Nederlandse Norm Gezond Bewegen (NNGB), Fitnorm and the Combinorm. Current research shows that only 2% of adolescents (ages 12 until 17) reach the Fitnorm (RIVM & CBS, 2014). Recently the Dutch Health Council released a report which advises children from 4 to 18 years of age to perform a daily minimum of 1 hour of somewhat intense activity (NNGB) and at least 3 times a week of muscle and bone promoting activities (Fitnorm; Gezondheidsraad, 2017). Further increasing the number of activities recommended from at least 2 moments of medium to high intensity exercising to 3 moments per week (TNO, 2013). Additionally, the positive effects of regular physical activity (Ford et al., 2009) as well as negative effects mentally (Fox, 1999) and physically (Strong et al., 2005) of too little physical activity have been well established. Any attempts to increase physical activity in this target group are thus quite desirable. One of the breeding grounds for a positive attitude towards healthy amounts of physical activity are the Physical Education (PE) classes provided at (high) schools (Stegeman, 2007). There is clear evidence that children who were taught a basis for movement skills during their childhood lead a more active life as adolescents (Bailey, 2000) as well as adults (Malina, 1996). A review of several retrospective and longitudinal studies by Raitakari et al. (1994) shows that participation in sports and physical activity in adolescence is a significant predictor for the activity level of adults. Furthermore Raitakari et al. (1994) concluded that inactivity during childhood leads to inactivity during adulthood. Trudeau and Shephard (2005) concluded in their literature study that the quality of PE classes is a great predictor for attitudes towards physical activity in adult life. To ensure that this quality is of the highest level possible, continuous research and development in the field of PE is an obvious choice. Central to the PE classes in the Netherlands two main goals are defined (Bax et al., 2017). These goals state that a student should: 1. learn a basis of movement skills. 2. develop competence and enthusiasm to participate in physical activities and sports (Bax et al., 2017). In order to gain enthusiasm in any kind of physical activity, at the very least one needs to enjoy this activity.

In our literature review below, we investigate determinants of behaviour and focus more specifically on theories of motivation in achievement contexts. For these motivational theories, we will consider both the disposition of a person as well as the perceived climate. Furthermore, we will consider whether fitting the climate to a person's disposition would yield positive effects. Which will lead to formation of our research question and hypotheses for the current study.

2 Literature review

Research of behaviour has identified many different determinants for people's behaviour. Development of area specific behaviour change models, has lead to a growing diversity of taxonomies and models. Whilst capturing parts of the mechanisms underlying the behaviour for the specific areas, most models are often not as-is applicable to different areas (Michie et al., 2011). In an attempt to unify these models, Michie et al. (2011) created a uniform taxonomy and framework (Behavioural Change Framework; Michie et al., 2013). This framework was developed using 19 existing behaviour change theories, such as the intervention mapping protocol (Bartholomew Eldregde, Markham, Ruiter, Kok, & Fernandez, 2016) and the MINDSPACE framework (Institute for Government, 2010) and can thus be considered quite comprehensive (Michie et al., 2011). At the heart of this framework lies the COM-B model, which was developed by Michie et al. (2011); Michie, West, Campbell, Brown, and Gainforth (2014). The COM-B model was intended to point out determinants of behaviours (Michie et al., 2011, 2014). The model consists of three components: *capability, opportunity and motivation* (COM) which influence *behaviour* (B). These components provide a basic explanation as to why behaviour might or might not occur. Each component influences behaviour directly and moreover, *opportunity* and *capability* might influence *motivation* and thus also indirectly affect behaviour. Lastly, behaviour can in turn influence *capability*, *opportunity* and *motivation* (see Figure 1). We can visualise these three components and their six subdivisions in an example: *imagine yourself wanting to play football.* To do so means that you will have to have the *capability* of doing so physically (i.e., muscle strength and some skill) and psychologically (i.e. attitude, you want to play football and know the rules of the game). Then you'll need to have the right *opportunity*, both physically (i.e., a playing field is nearby and you have a football at hand) and socially (i.e., within the given context it is socially acceptable to play football) and lastly you'll need the right *motivation* either reflectively (i.e., carefully thought through what the consequences are going to be of your action to play football) or automatically (i.e., making the decision to play football based on your emotions).

Since PE lessons are considered as one of the key places to motivate adolescents to perform physical activity with a lasting effect (Bailey, 2000; Malina, 1996; Trudeau & Shephard, 2005) we will consider the COM-B model in light of this context. Firstly, we will consider capability: We can state that psychological capability (i.e. attitude) is believed to be a predictor for behaviour by Michie et al. (2011); Orji (2014). Whilst Bauman et al. (2012) contradicts this theory for children below the age of 12, the researchers did find a correlation between attitude and movement behaviour for children between 12 and 18 years of age. Regardless, attitude has been researched by Keulen, Chorus, and Verheijden (2011). They concluded that a majority (51.3%) of youth in the ages 12 to 17 years have a positive cognitive attitude towards more healthy exercise, whereas a great portion have a neutral cognitive attitude (34.4%) towards more healthy exercise. As for affective attitude towards more healthy exercise: 46.6% determined this as nice, whilst 38.8% had a neutral affective attitude towards more healthy exercise. This leaves, a negative cognitive attitude amongst 11.3%

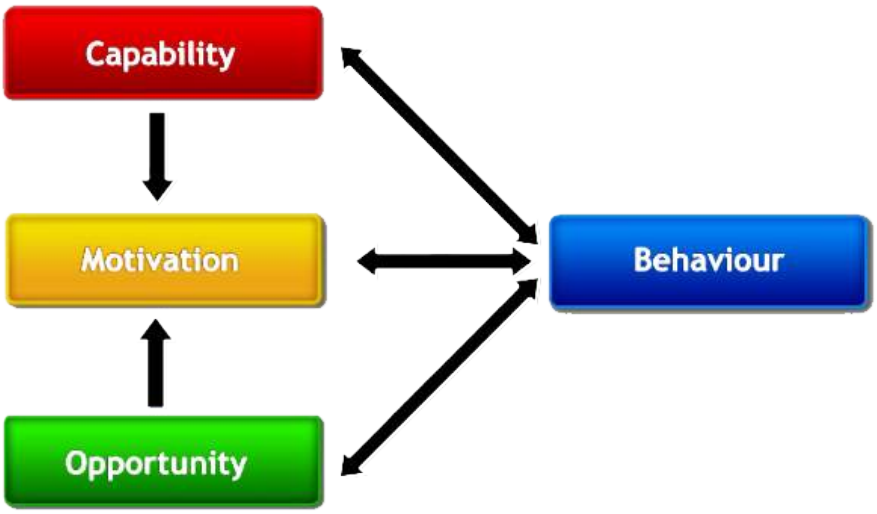

Figure 1. COM-B model (Michie et al., 2011)

and a negative affective attitude amongst 14% of the respondents towards more healthy exercise. Thus, overall students mostly have either a neutral or a positive attitude towards more healthy exercise. Next, we should consider physical capability, which is quite diverse in the context of PE-lessons, students differ in background, general fitness and amount of sports that they practice outside of the PE context. Differences between students are and will always be a present. Whilst this might affect behaviours, the only solution to equalise these differences is to group people with the same physical capabilities together. Secondly, we consider physical opportunity and social opportunity. Physical opportunity should not be a challenge for PE lessons in the Netherlands, since these lessons are mandatory by law and are therefore provided for with at least the bare minimum in terms of materials, rooms and teachers. Furthermore, social opportunity: Whilst one might think that the context of a PE lesson is strictly built to allow for students to perform physical activity, the construct might be more comprehensive than merely the physical context. Social interactions between the students might promote or deny a student to perform physical activity (e.g. a student might feel insecure next to other students constraining the student in performing). Although we should consider the possibility that this construct might influence our research, it will not be the main focus of the current thesis. The last component in the COM-B model is motivation, which will be our main focus.

Research on motivation has identified many different theories explaining people's motivation (Vansteenkiste & Mouratidis, 2016; Wentzel & Miele, 2009). One such theory is the achievement goal theory. This theory has been applied in many different settings within school and sports (Nicholls, 1984; Treasure & Roberts, 2001). Achievement goal theory defines motivation as the energisation and direction of competence relevant behaviour (Elliot & Church, 1997). This is best understood not as a function of energisation or arousal per se, but rather as a function of the goals behind the motivated activity (Elliot & Church, 1997). Nicholls (1984) and Dweck (1986) were

amongst the first to discover patterns emerging from their data leading to the conceptualisation of achievement goals. Whilst similar in effect, both researchers used different names for their discovered patterns. Dweck (1986) called them mastery (learning) or performance response patterns whereas, Nicholls (1984) called them task involvement or ego involvement. Within these studies, the mastery response pattern or task involvement was seen as a positive response, e.g. "*I failed because I did not put enough effort into this task*" (in response to failure). Whilst a performance response pattern or ego task involvement was seen as a negative response, e.g. "*I failed because I lack ability, and I don't want to persist any-more*" (in response to failure). For several years the dichotomous model, conceptualised by both Nicholls and Dweck was considered a valuable motivation theory in achievement contexts.

A second framework was proposed by Elliott and Harackiewicz (1996) which distinguished between three goals: mastery (learning) goals, performance-approach goals and performance-avoidance goals (Table 1.). They claimed that whilst mastery (learning) goals are solely aimed at increasing competence, performance goals can be divided amongst valence (approach or avoid). A performance approach goal can be thought of as someone who is inclined to show competence (e.g. running faster then other students your age), whereas a performance avoidance goal can be seen as avoiding to show incompetence (e.g. not failing to run 5 kilometers during a competition). Allowing for either a positive or a negative response on the performance goal definition. The approach-avoidance framework was supported by several studies (Elliot, 1999; Elliot & Church, 1997) as well as two meta analysis studies (Elliott, 1994, 1995), which confirmed that over 90% of the experiments analysed supported an approach-avoidance model.

Table 1

Trichotomous Achievement Goal Framework Elliot (1999)

Definition vs Valence	Mastery direction	Performance direction
Approach	Mastery (+)	Performance Aproaching (+)
Avoid		Performance Avoidance (-)

Table 2

2x2 Achievement Goal Framework Elliot and McGregor (2001)

Definition vs Valence	Mastery direction	Performance direction
Approach	MAp (+)	PAp (+)
Avoid	MAv (-)	PAv (-)

Elliot and McGregor (2001) followed up the trichotomous framework (Table 1) with a 2x2 framework (Table 2) which included an avoidance valence dimension on the mastery definition as

well. They hypothesised that avoidance of mastery is found when an individual already mastered a skill, but did not want to lose it (e.g. when people start to age they don't want to loose their cognitive prowess, thus their motivation to keep doing brain puzzles stems from not wanting to lose the skill, rather than improve on it). With this addition Elliot and McGregor (2001) formed the currently well known 2x2 achievement goal theory (AGT; Table 2).

Furthermore, research by Van Yperen (2006) determined that although dispositional achievement goal orientations are often considered as independent levels. That is, a person scores independently on each direction (mastery vs performance) and valence (approaching or avoiding). For example, a person could score high on mastery approaching as well as performance approaching. Van Yperen (2006) hypothesised that through the right type of questionnaire (i.e. fixed choice) a dominant achievement goal orientation can be determined for individuals. Whilst relatively new to the field of achievement goal theory, support for these questionnaires has been found lately (Van Yperen & Orehek, 2013).

Achievement goal theory can be found within two different definitions, namely in motivational climates as well as dispositional goal orientations. In a motivational climate, the teacher can establish either a mastery or a performance oriented climate. Such that, either the students are encouraged to learn and improve themselves (mastery) or students are compared against other students, increasing rivalry amongst students (performance; Ames, 1992; Keegan, Spray, Harwood, & Lavallee, 2011; Treasure & Roberts, 1995, 2001). Additionally to this climate, there are the social and environmental structures around the individual which in turn influence the perception of the motivational climate. As such, there are many influencers and mechanisms which determine motivation. In addition to this climate, there are the dispositional achievement goal orientations of students which can be aimed at both definitions (mastery vs performance) and spread out along valences (approaching vs avoiding). These levels are independent of each other, therefore one student could have a high disposition towards mastery approaching as well as performance avoiding, whilst another could score high on both mastery approaching as well as performance approaching (Elliot & McGregor, 2001). Furthermore, one should consider that levels of motivation as well as goal directions differ per activity. While a person might be highly motivated in a mastery approach orientation towards a mathematics assignments, the same individual might score completely different in a condition where goal orientations towards a sporting activity are assessed. Achievement goal orientations are thus very specifically task related (Hassmén, Keegan, & Piggott, 2016). Moreover, the motivational climate has a defining influence on the dispositional goal orientation (Hassmén et al., 2016).

Earlier research investigated whether a match between participants' dispositional achievement goal orientation and participants' (measured) perceived motivational climate would yield positive effects, but these studies found inconsistent results (Bortoli, Bertollo, & Robazza, 2009; Keegan et al., 2011; Morris & Kavussanu, 2009). We argue that an important reason for this inconsistency was that these studies measured the motivational climate rather than manipulate the motivational cli-

mate. Day-to-day situations always contain triggers of both types of achievement goals, such as the components of the TARGET framework: Task, Authority, Recognition, Grouping, Evaluation, and Time (TARGET; Ames, 1992; Epstein, 1987, 1988) describe. However, these triggers might cause a motivational climate to trigger both a mastery and a performance oriented climate. We argue that by activating the motivational climate more explicitly, the activation will trigger more specifically a mastery or a performance oriented climate. Thereby, the fit between dispositional goal orientation and motivational climate can be as optimal as possible, maximising positive effects. That is, positive motivational effects are to be expected when for example a performance oriented task is given to a person with a dispositional performance approach goal orientation. Based on research done by Wang, Biddle, and Elliot (2007) we argue that by maximising the fit between dispositional achievement goal orientation and achievement goal within the task, the enjoyment of the task will increase.

Therefore, we propose the following research question:
What is the influence of activating a mastery climate versus a performance climate, and the dispositional achievement goal orientation (mastery to performance) of the participant on the participant's enjoyment of a target behaviour, in the context of PE class exercises?

To be more specific, we will analyse what type of motivation goal and what kind of fit to a dispositional achievement goal orientation would be best to maximise the enjoyment of a PE student. Thus, the following hypotheses were developed:

H_1) We expect that participant's task enjoyment will be highest when there is a better fit between the activated achievement climate and the dispositional goal orientation of a participant.

H_2) We expect that when a mastery climate has been activated, participants enjoy the task better, than when a performance climate has been activated.

To intervene in a context in such a way that it promotes either a mastery or a performance climate means that we should also consider minimising other influencers to maximise the possibility for a climate to be considered mastery or performance oriented. To influence a context in a structured and all-encompassing manner, we use the TARGET framework (Ames, 1992; Epstein, 1988). For this we will design an activation of both climates individually (i.e. performance and mastery). Assessments of enjoyment in these activities and assessments of the motivational climate should provide us with enough data to confirm or deny our hypotheses.

TARGET Framework
Our behaviour is influenced by many elements (Michie et al., 2011). In an attempt to gather these influencers for achievement goal climates the TARGET framework was proposed by Ames (1992); Epstein (1988). This framework consists of six components, following the acronym TARGET, in-

cluding: task design (T), distribution of authority (A), recognition (R), grouping (G), evaluation (E), and time allocation (T) (Ames, 1992; Epstein, 1988; Ntoumanis & Biddle, 1999). Depending on the utilisation of each of these constructs one can nudge the climate towards a more Mastery or Performance climate (Epstein, 1989). For example *recognition* for an achievement can be given privately and based on individual progress (mastery), or publicly and based on social comparison (performance).

3 Method

In order to examine the influence of activating motivational climates fitting Participants in the experiment attended PE classes during which they took part in two running activities. The study followed a 2 (activated goal: mastery vs performance) by 2 (fit: fit vs non-fit) design, with both activated goal and fit as within-subject variables. Enjoyment in the activity is measured as a within subject dependent variable. All data gathered during the experiment was entered into a MySQL database and loaded via an ODBC connector into STATA 14.2. (StataCorp LLC, 2018) for analysis.

3.1 Participants

Participants of this study were recruited from 2 high schools in the vicinity of Eindhoven: Het Strabrechtcollege, located in Eindhoven and Dr. Knippenbergcollege, located in Helmond. Both high schools responded to a request sent out to a list of high schools with over 800 students and gym rooms within the school. The schools first received a formal briefing on the experiment setup and were asked to arrange a signed informed consent from the daily board of the school. If additional consent from the parents/guardian was required, the school would request these together with an informative letter regarding the experiment. Both schools convenience sampled the classes which had 2 hours of gym at the same time to minimise the inconvenience on the participants. Participants were included either by active consent of student and parent or by school-wide inclusion. Participants differ in knowledge background ranging from VMBO (Preparatory middle-level vocational education) to HAVO (Higher general secondary education), and VWO (Preparatory scholarly education) and are currently in grade 1 or 2. Subgroups were created per class, keeping an equal distribution amongst gender across all groups, as can be seen in Table 3. All 148 participants in our sample filled out the first questionnaire, however 11 participants were omitted because they did not participate in the rest of the experiment, mostly due to health or planning issues. Among the participants in our final sample there were 60 females, 77 males ranging in age from 12 to 15 years ($M = 13.06, SD = .83$).

Table 3

Distribution of Gender Across Subgroups (N = 137)

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Males	6	7	6	3	5	7	5	6	6	5	4	4	6	3	4	77
Females	5	4	2	2	3	3	4	5	4	4	5	6	4	5	4	60

To determine the necessary sample size, literature research was conducted. An effect size was found based on a meta-analysis study by Ntoumanis and Biddle (1999). They found that some studies report a medium to large effect size for positive effects (i.e. enjoyment) in a mastery climate and a small to medium effect size for a positive effect in a performance climate. Although these

high effect sizes were found in the data, Ntoumanis and Biddle (1999) state that upon reviewing the literature narratively, it would appear that these effect sizes are exceptionally high. Therefore a more conservative effect size was used in the power analysis. Using G*Power (version 3.1.9.2), we performed an a priori power analysis for linear multiple regression (fixed model, R^2 deviation from zero) with an effect size $f^2 = 0.12$ resulting in a sample size of 123 participants needed to achieve a power > 0.9. To accommodate for missing data and to allow inclusion of complete classes this study aimed for a sample size of 180 participants. The only inclusion criterium was that participants should be students from high school grades 1, 2 or 3. The PE teacher received a small financial reward per participant participating to arrange a reward for the class. This reward was not used to incentivise participants into participating in the study.

3.2 Measures

3.2.1 Demographics

Demographics of each participant were obtained directly from the school and pre-filled on each questionnaire. These demographics consisted of the age and grade of participant. The participants were asked to review these demographics and alter if found incorrect. Furthermore the school provided the gender of the participant, which was not asked for on the questionnaires.

3.2.2 Dispositional Achievement Goal Orientation

Our main independent variable: The dispositional achievement goal orientation of the participant was measured by the first questionnaire in our study. This questionnaire was provided entirely in Dutch. To measure the participants' dispositional achievement goal orientation (aimed at PE lessons) the Achievement Goal in Physical Education Questionnaire (AGPEQ; Wang et al., 2007) was used. A Dutch translation of this questionnaire by Wang, Biddle, and Elliot (2016) was used in this study. The questionnaire consisted of 12 questions on a 5-point Likert-scale. Two questions were omitted due to a low internal consistency score. Cronbach's alphas for the different orientation sub-scales were calculated to be: performance approaching (2 items; $\alpha = .90$), mastery approaching (3 items; $\alpha = .82$), performance avoiding (2 items; $\alpha = .57$) and mastery avoiding (3 items; $\alpha = .72$). All except for the measure of the performance avoiding orientation showed good internal consistency. In our final analysis we did not use the measure for performance avoidance. Therefore the low internal consistency is of no direct effect for this study. The participants' achievement goal orientation was also measured by the the dominant achievement goal questionnaire (Van Yperen, 2006; Van Yperen & Orehek, 2013). Van Yperen and Orehek (2013) suggested that measuring which achievement goal orientation is dominant can be an equally well performing predictor in comparison to orientations towards all achievement goals. This measure was included in the first questionnaire and consisted of six dichotomous questions which were asked in a round robin and forced-choice manner. These questions were supported by four items on a 7-point Likert-scale which were used to assess the strength of each achievement goal.

3.2.3 Enjoyment

Our main dependent variable: Enjoyment in the activity, is measured by the PACES questionnaire (Kendzierski & DeCarlo, 1991; Motl et al., 2001). The questionnaire was translated to Dutch by (Ven, 2016) and consisted of 18 questions on a 5 point Likert-scale both positively and negatively framed. This measure was used twice, once for each activity: mastery ($\alpha = .95$) and performance ($\alpha = .96$). Before statistical analysis the questions were reverse coded and mean scores were calculated.

3.2.4 Achievement Goal Climate Assessment

To measure the participants' perception of the achievement goal climate the MCSYS questionnaire (Smith, Cumming, & Smoll, 2008) was used. This questionnaire is an adaptation of the PMCSQ-2 questionnaire (Newton, Duda, & Yin, 2000) fitted to be easier to comprehend by children of younger ages. This questionnaire was translated to Dutch by Wang et al. (2016) and re-framed to target specifically this studies' activities. Two questions were removed from the measure as re-framing these questions was not possible. Leaving 10 questions on a 5 point Likert-scale to evaluate the perception of the achievement goal climate. Cronbach alpha's were calculated for each direction within each activity: mastery activity: (mastery climate $\alpha = .73$; performance climate $\alpha = .65$) and performance activity (mastery climate $\alpha = .71$; performance climate $\alpha = .70$). Lastly, two additional questions were added. One to assess whether the participants felt afraid that they might do the activity in a wrong way: "*was ik bang iets fout te doen*". And one to determine whether the participant was more focused on other participants than on themselves: "*hield ik mij meer bezig met de anderen dan mijzelf*".

3.2.5 Subjective Experiences

Additionally we measured the participants' subjective experiences regarding the activities and exercising during PE lessons. This was measured through 5 open ended questions, ranging from inquiries regarding their extracurricular sporting activities: *"Wat doe je nog meer aan sport / beweging buiten gymlessen op school?"*, to whether the participants would like to participate in the activities again: *"Zou je nog eens willen deelnemen aan een van deze activiteiten en welke zou dat dan zijn? (A, B of Geen) Omdat?"*. As well as what the participants would like to change in these activities: *"Als je iets mocht veranderen aan de activiteiten, wat zou dat dan zijn?"*, what the participants' experiences were towards the activity explanation cards: *"Wat vond je van de uitleg op de kaarten?"*, and in what conditions they usually enjoy PE lessons the most: *"Wanneer haal jij plezier uit een gymles?"*. These questions were subjected to thematic analysis following the method described by Braun and Clarke (2006).

3.3 Materials

3.3.1 Glowsteps

To manipulate the climate towards either a mastery or a performance climate, devices named: Glowsteps were used. Originally used as prototypes for open ended play at the Industrial Design department of Eindhoven University of Technology (De Valk et al., 2013). The Glowsteps consisted of: A micro-controller (ATMega2560V), 3 LED drivers (Flowsteps 2.0 LED Driver board; created 2012) containing 6 LED's each, an XBee Radio module (v1, 1mW), a speaker, a battery-pack, 3 capacitive pressure sensors, a triple axis accelerometer breakout board (MMA7361) and a Sparkfun audio-sound breakout board (see Appendix A). The components were connected or soldered on a single Printed Circuit Board (PCB). The exterior of the device consisted of a moulded plastic frame (Figure: 2 & 3). The pressure sensors were shielded from impact by 3 silicon caps which took away the initial force exerted on the sensors. The bottom of the Glowstep was shielded off by a wooden panel screwed into the plastic frame.

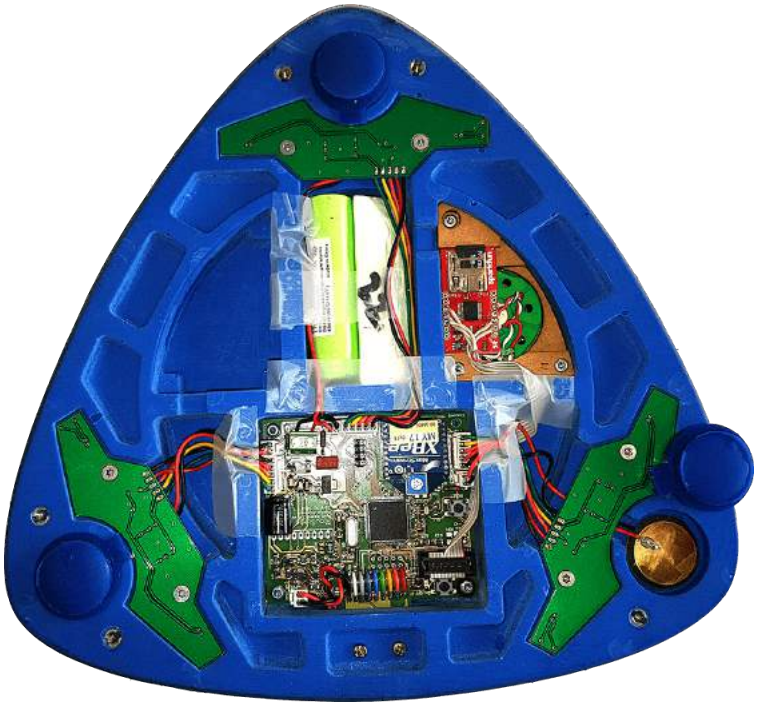

Figure 2. Electronics inside a Glowstep

The Glowsteps were programmed using the Arduino IDE (version 1.8.5) in C/C++. The ATMega2560V chip on the main PCB held the pre-compiled program. The program recorded when somebody would step onto the Glowstep and acted according to the current state (i.e. run, pause, or setup) of the Glowstep. The Glowstep would send out lap times through the XBee radio module which was configured as an end-point, sending data only to one fixed coordinator in the network. The Glowstep also received data sent by the coordinator XBee, more specifically:

acknowledgements of lap times, fastest round times and mode changes (i.e. run, pause, shut-down).

Figure 3. Glowstep in a gym room

3.3.2 XBee Radio Communication, Laptops & Software

For the current experiment both 1mW and 10mW (Pro) version 1 XBee's were used. 1 mW versions were already present in the Glowsteps. Two separate laptops were used to ensure two cleanly separated networks. A 10mW (Pro) and a 1mW XBee version were connected to each of these laptops. The connections to the laptops were made via an XBee Explorer USB from Sparkfun. The XBee's were configured to transmit on separated networks and channels. Also the XBee's were divided amongst end-points (in the Glowsteps) and coordinators (connected to the laptops). A full list of settings can be found in Appendix F and a full list of soft- and hardware in Appendix A.

Processing

Sending and receiving data from the XBee's occurred through Processing 3.3.6 (Processing Foundation) program and used an XBee library and the Bezier SQL library. Lap times were confirmed back to the Glowstep and entered, into the MySQL database after validation. Specifically for the Performance activity, the Processing program transmitted the fastest round times back to the Glowsteps after 6 lap times had been received. This allowed for the Glowsteps to calculate when

their participant was slower as opposed to the fastest lap time and change their colour to red accordingly.

3.3.3 Performance Screens

Specifically for the performance activity two television screens were set-up to show a web page with the lap times of each participant sorted by gender and ordered from fast to slow (figure 4). These screens were both connected via a HDMI cable and splitter to the performance laptop. The website shown on these screens was connected to the MySQL database to retrieve the lap times. Combined with a jQuery solution that reloaded the website, this ensured that the data presented was updated in real-time.

Figure 4. Performance screens

3.3.4 Identification Stickers, Instruction Cards & Video

Name stickers (Figure 5) were made before the two activities commenced. These stickers contained the subgroup id and assigned Glowstep per activity. Ensuring that the participants were all correctly positioned at the right Glowstep with minimal interference. Furthermore the stickers and random generation of subgroups removed any bias a teacher could bring about in assignment of subgroups. Instruction cards listed the procedure per activity and were written in either a mastery approach- or a performance approach activating manner. These instruction cards were used to minimise climate influences by explanations of the teacher as well as to increase the variance between both activities (see Appendix G). Lastly, during the experiment a video camera with a wide angle lens captured the gym room. This data was used to analyse whether participants ran together in groups during the activity and whether a participant might show behaviours that influence the activity.

3.4 Experiment Setup and Procedure

The current study took place during PE classes and was spread out over two days in a period of eight days (see Figure 6). There was contact with the researchers on day one and eight. The full

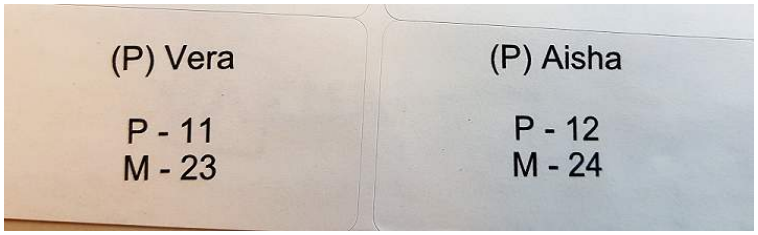

Figure 5. Participant sticker

procedure can also be found in Appendix B.

3.4.1 Opening questionnaire (day 1)

On the first day the participants were explained the purpose of the research, their rights, that the study was completely anonymous and that grading would not occur. Afterwards, the participants were asked to fill out a questionnaire (see Appendix C) measuring their dispositional achievement goal orientation. These questionnaires were pre-numbered with a participant identification number and spread out across the PE room. Attached to each questionnaire was a sticky notes with the first name of the participant. Participants were instructed to find their own questionnaire, remove the sticky note and fill out the questionnaire. In the days following the researchers would enter the participants' data into the MySQL database (MySQL 5.7.19) coupled to their assigned identification numbers. Afterwards, the researchers would create subgroups amongst these participants. In order to minimise effects of social influences participants were randomly assigned by the MySQL database which held all participant data. Gender was given as the only fixed variable for this division to allow for similar amounts of the same gender across all subgroups (Table 3).

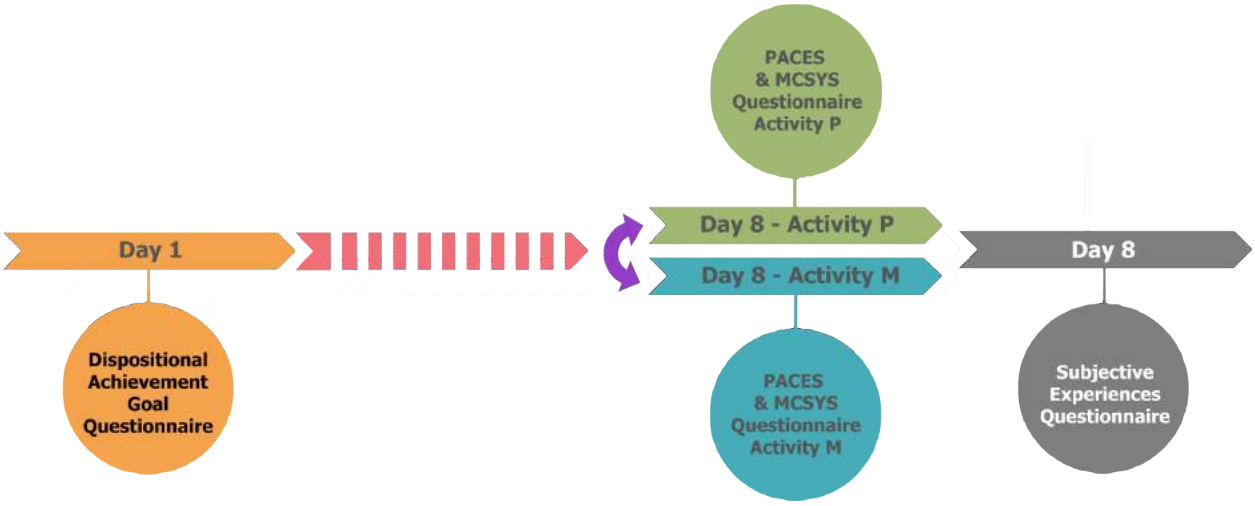

Figure 6. Timeline of the Experiment

3.4.2 Activities (day 8)

On the last day of the experiment the participants would meet the researchers again in the schools' PE room were the experimental setup was placed. These setups took roughly one PE room per activity. In schools which did not have two PE rooms available at the same time, the activity would be swapped halfway through the experiment. All subgroups would thus first participate in activity A (Mastery) and afterwards in activity B (Performance). The order of both activities was not fixed, so if two classes participated after each other, class 2 would conveniently start with activity B (Performance) after which the activity would be swapped back to activity A (Mastery). After arrival the participants received stickers containing their name, subgroup number and two unique identification numbers which determined the activity and position (Glowstep) at which the participant would start. The participants received a general explanation of the experiment and were once again ensured that participation would be completely anonymous. Furthermore they were told that answering honestly was of vital importance to the experiment and were explained, to a lesser detail, what was being tested. The participants were then asked to head to their assigned activities. In both conditions the researcher would hand out activity cards (see Appendix G) explaining in detail and visually supported what was expected of the participant and with which goal in mind they would participate (e.g. *"try your best to win from the other students"*). After the participants were done reading these cards the researcher would answer any questions and if needed elaborate on the activity once more. After none of the participants had any questions left, they were asked to go to their starting positions and wait for the starting signal. Both activities lasted roughly 5 minutes as was monitored by the researcher on a stopwatch. Halfway through the activity the time remaining would be communicated, as well as the last 30 and 10 seconds. After each activity the participants were asked to evaluate their enjoyment towards this specific activity as well as their perception of the achievement goal climate during this activity by filling out the PACES and MCSYS questionnaire (see Appendix D). These questionnaires were placed on the PE room floor equally spaced apart to minimise social influences when filling out the questionnaire. One of the questionnaires had the questions in a randomised order to minimise the effects of order and recall on answering the questionnaires. Furthermore the questionnaires contained a sticky note with the name of the participant on it to ensure that the participant would fill out the questionnaire associated with their identification number. Below we will elaborate further on the activities.

Activity A - Mastery Approach Activated

In activity A, the participants were asked to improve their own lap time. Each participant started with a lap time of 40 seconds. During the laps the Glowstep would flash green in a rhythm corresponding with the time left for that lap. After each lap the new lap time was saved as the time to beat for the next lap. If the participant failed to improve their lap time, the time to beat would reset back to 40 seconds and the participant would have to start over. Feedback in this condition was only given via the LED's in the Glowsteps. Flashing green if the participant was faster in comparison to the last lap. Flashing red if the participant had not managed to be faster then the

last round. All Glowsteps were set up directly behind each other spread out over both long sides of the PE room to ensure minimal feedback of, and social interaction with other participants (Figure 7).

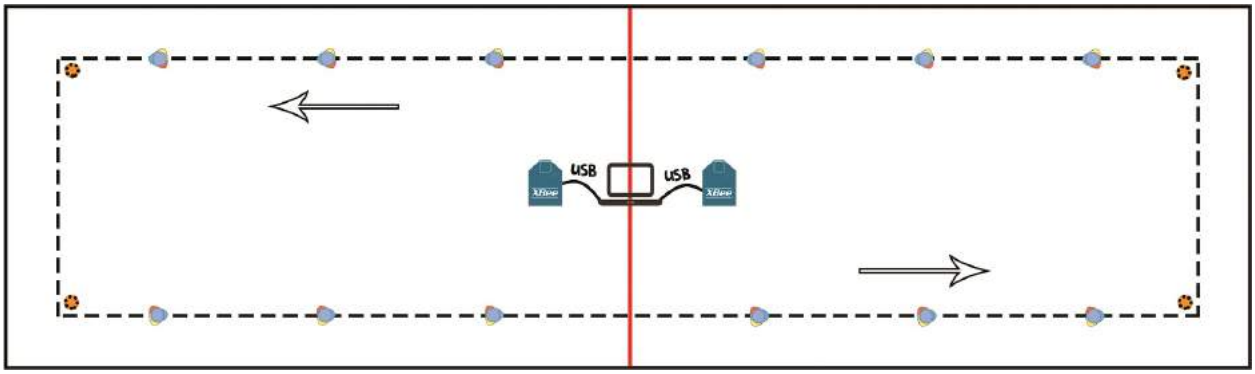

Figure 7. Schematic of mastery activity

Activity B - Performance Approach Activated

In activity B, the participants were asked to compete against other participants of their own gender. Either two or three participants started next to each other. Average round times sorted by gender were shown on two television screens facing the participants (figures 8 & 9). The Glowsteps were positioned next to each other to allow for easier comparison amongst participants. Feedback regarding the current position of the participant relative to others in their gender was given through the television screens in a high score table. As well as, via the LED's in the Glowsteps, which turned red when the participant was slower in comparison to the fastest participant of their gender and was green as long as the participant was faster in comparison to the fastest participant of their gender. Participants were divided over 4 starting positions throughout the PE room (Figure 8).

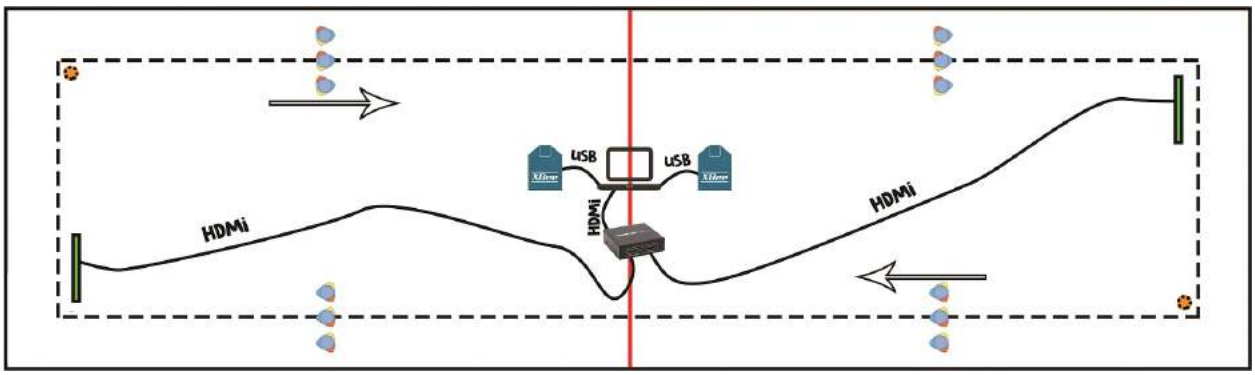

Figure 8. Schematic of performance activity

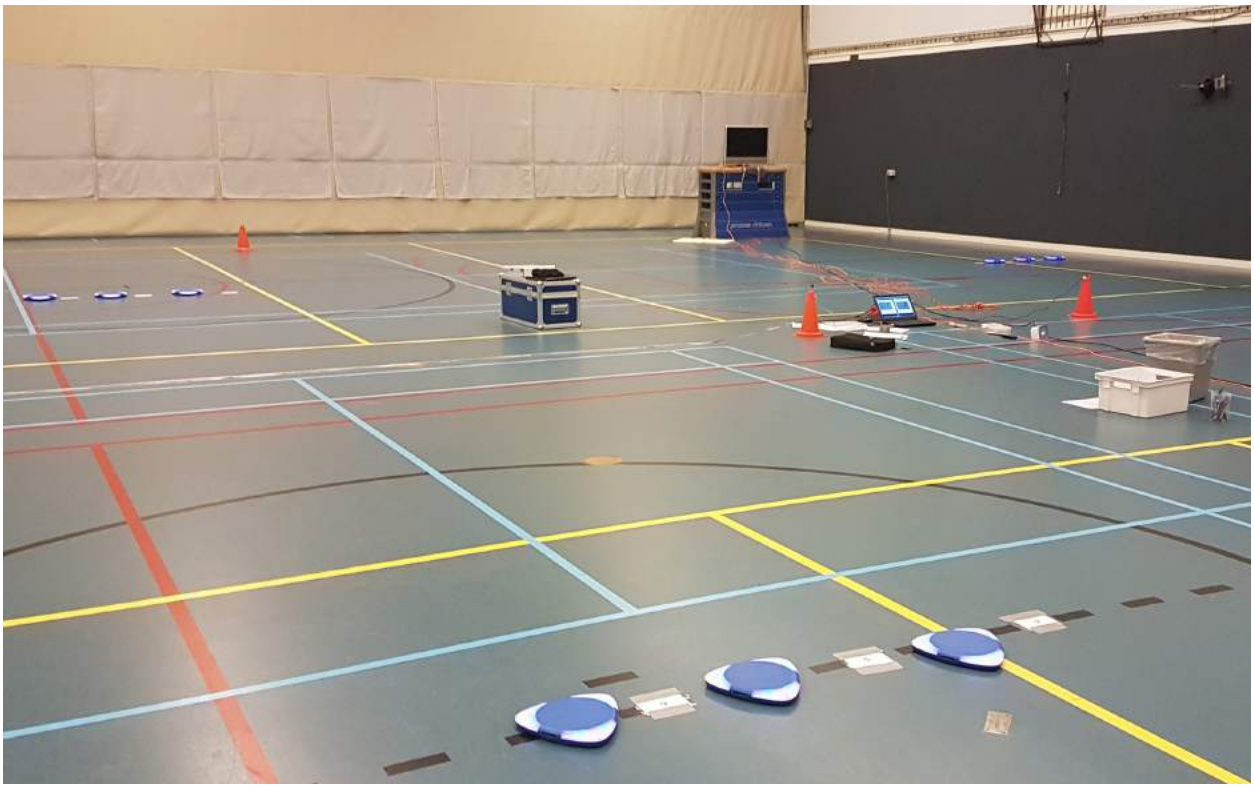

Figure 9. Setup of performance activity in a gym room

3.4.3 Closing Questionnaire (day 8)

Directly after the second activity and questionnaire was completed participants were asked to fill out the closing questionnaire (see Appendix E) which measured subjective experiences and affiliation with sports. These questionnaires were also spread out equally across the PE room to minimise social influences in the participants' responses. After completion the participants were thanked for their participation and continued the PE class with their PE teacher.

3.5 Pre-Test

To determine the effectiveness of the motivational climate manipulation proposed before the experiment a pre-test was executed. Participants of the pre-test were recruited amongst the youth members of a Scouting group in the vicinity of Eindhoven (51°28'24.1" N, 5°35'03.3" E) by means of an e-mail. The sample consisted of 4 males and 8 females in ages ranging from 11 to 15 years ($M = 12.6$, $SD = 1.17$) which is a little younger in comparison to the main study which focuses on the age range 12 to 15 years. Participants were asked which of the two activities (A, B or none) was focused on performing better as opposed to the others (*"beter te doen dan de anderen"*), for which all participants ($n = 12$, 100%) answered activity B (Performance). Secondly, the participants were asked which activity was focused on learning to become better (*"mezelf te verbeteren"*) for which 9 participants (75%) answered activity A (Mastery) and 3 participants answered both

activities (25%). Furthermore to examine whether the questionnaires and activity cards did not contain any difficult taxonomy or unclear questions these were used during our pre-test. The PACES and MCSYS questionnaire were only used during the Mastery condition. Assessments of the mastery ($M = 3.48$, $SD = .81$) and performance ($M = -.3$, $SD = .5$) climates during this test were submitted to a paired sample ttest which showed that the activity was found significantly more mastery oriented as opposed to performance ($t(11) = 12.14$, $p < 0.001$). The activity cards were evaluated via an open question (*"Wat vond je van de uitleg op de kaarten?"*) to which 11 participants (91.67%) responded that the cards were clear (*"duidelijk"*; $n = 7$, 58.33%) or good (*"goed"*; $n = 6$, 50%). 3 participants (25%) remarked that the activity cards contained a lot of text (*"veel lezen"*). Small changes to the activity cards were made to shorten it in length and make them more visually appealing. From these results we concluded that the current manipulation in our experiment would potentially yield the expected results.

4 Results

All statistical analyses were performed using STATA 14.2 (StataCorp LLC, 2018).

4.1 Outlier Analysis

Questionnaire data was checked for consistent answering patterns in accordance to methods described by Van Den Broeck, Cunningham, Eeckels, and Herbst (2005). As the questionnaires were counter-balanced (i.e. positive and negatively framed items questioning the same construct). Participants which answered solely on one far end of the Likert scales would consider the activities both extremely enjoyable and extremely not enjoyable at the same time. Leading us to belief that the participant did not answer the questions truthfully. This method revealed two participants which consistently answered the questions in all questionnaires on the low end of the Likert scale. All data from both participants were therefore removed from the dataset in all further analysis. Participants that answered the questionnaires consistently in the middle of the Likert scale were kept in our dataset as we cannot determine whether these participants actually perceived the activities as equally enjoyable and not enjoyable, or if this was also due to a lack of enjoyment in filling out questionnaires. Secondly, we evaluated the computed standardized z-scores on enjoyment, climate assessments and dispositional achievement goal orientations. One z-score larger than 3.00 was found and none lower than -3.00, thus only one participant had a value which was higher than 3 standard deviations away from the mean in our data. This potential outlier was examined by checking their questionnaire data, however no obvious extremes were observed. Furthermore removal of the participant from the dataset did not turn out to have any effect on the effects found in the analysis as described below, thus the participant's data was left in the dataset.

4.2 Manipulation Check

To assess whether the manipulation of the participants' climate was effective, a manipulation check was performed. We submitted the participants' climate assessment of the activity to a 2 (condition type: mastery manipulated vs. performance manipulated) x 2 (assessment type: mastery assessment vs. performance assessment) repeated measures analysis of variance. This test showed us that there was an interaction between the 2 factors ($F(1, 536) = 28.85$, $p < 0.001$; see Figure 10). Confirming that our manipulation was able to activate a performance climate, results showed that participants' assessment of the performance climate was higher after they had just completed the performance activity ($M = 2.51$, $SD = .92$) than right after they had completed the mastery activity ($M = 2.05$, $SD = .79$), as indicated by a simple main effect of activity type for performance climate assessment ($F(1, 536) = 18.39$, $p < 0.001$). Results however suggested that our manipulation was not able to activate a mastery climate. That is, in the same manner we tested whether there was a difference in mastery climate assessment between the mastery activity ($M = 2.94$, $SD = .93$) and the performance activity ($M = 2.89$, $SD = .91$). This however was not the case, that is participants' subjective experiences of the mastery climates were not significantly different

since no simple significant main effect was found of activity type for mastery climate assessment ($F(1, 536) = .21$, $p = 0.64$).

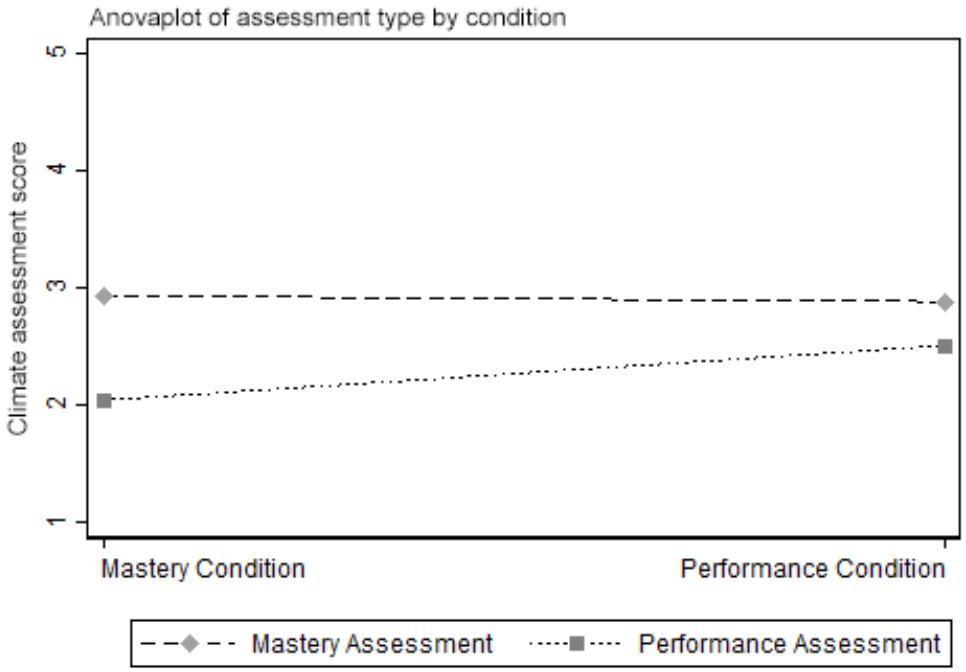

Figure 10. Climate assessment scores per condition

4.3 Hypothesis Testing

Our main hypothesis states that: *"We expect that participant's task enjoyment will be highest when there is a better fit between the activated achievement climate and the dispositional achievement goal orientation of a participant"*. To assess whether our main hypothesis (H_1) holds, we tested whether the enjoyment during a task is predicted by the participants' dispositional achievement goals and is moderated by the type of activated goal (condition type: mastery or performance) (see Figure 11).

A mixed effect multi level model was calculated to predict enjoyment based on a participants' dispositional achievement goal orientations (aimed at: mastery approaching or performance approaching) and moderated by condition type (mastery or performance condition) as fixed effects. The model included condition type (mastery or performance) as random effect. The model was found to be significant: ($\chi^2(5, N = 135) = 64.43, p < 0.001$). We found an effect of dispositional mastery approach orientation on enjoyment ($p < 0.001$). However, we did not find an effect of activated goal (condition type) on enjoyment ($p = 0.378$). As we observed earlier in our manipulation check, our manipulation did not fully succeed, that is only the activation of the performance climate showed promising results. In contrast we found that the activation of the mastery climate

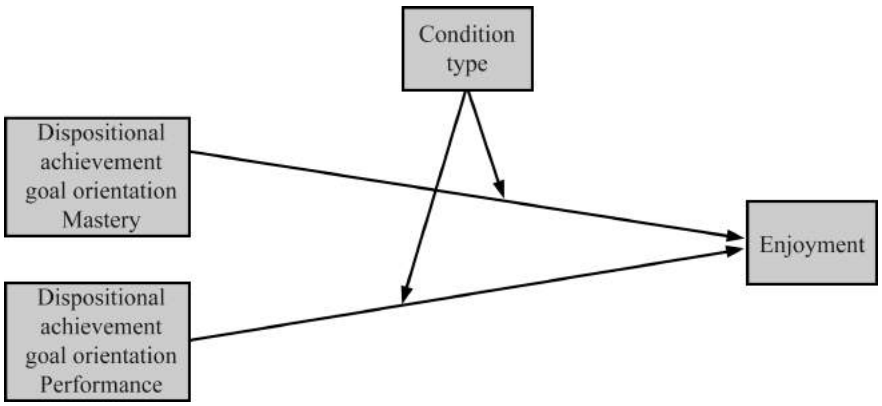

Figure 11. Model of condition type moderating effects of disposition on enjoyment

Table 4

Mixed effect multi level model with condition type as a moderator

Enjoyment	Coefficient	Std. Error	Z-value	p-value	95% Conf.	Interval
DAGO Mastery Approach	0.45	0.10	4.63	0.000	0.26	0.63
DAGO Performance Approach	0.05	0.07	0.81	0.417	−0.08	0.18
Condition Type	−0.50	0.56	−0.88	0.378	−1.6	0.07
DAGO Mastery Approach ∗ Condition Type	0.10	0.14	0.73	0.465	−0.17	0.37
DAGO Performance Approach ∗ Condition Type	0.06	0.09	0.64	0.523	−0.12	0.24

was unsuccessful, that is both activities were assessed as equally mastery oriented. In our model we observed that dispositional mastery approach orientation was a predictor for enjoyment. Since both climates were assessed as equal and highly mastery oriented we were led to belief that due to this mostly mastery oriented nature of both climates, people who were more dispositionally mastery approach oriented gained more enjoyment. However, this does not confirm our first hypothesis.

Therefore, we will assess our model from a different angle, that is by changing the assumption that our manipulation worked entirely. Since both climates were found to be highly mastery oriented, we added climate assessment as a moderator for a participants' disposition. This allows us to assess whether enjoyment is predicted by disposition whilst taking into account the subjective experience of the activities' climate (see Figure 12).

A mixed effect multi level model was calculated to predict enjoyment based on a participants' dispositional achievement goal orientations (aimed at: mastery approaching or performance approaching) and moderated by climate assessment (mastery assessment or performance assessment) as fixed effects. The model included condition type (mastery or performance) as random effect. The model was found to be significant: ($\chi^2(8, N = 135) = 188.41, p < 0.001$). Within the model we found four predictors (Table 5), which were: dispositional mastery approach orientation ($p = 0.019$),

dispositional performance approach orientation ($p = 0.046$), climate assessment mastery ($p = 0.006$) and the moderation between dispositional performance approach orientation and climate assessment in the performance direction ($p = 0.031$). Again we observe that dispositional mastery approach orientation is a predictor, as well as mastery assessment of the climate which is coherent with our previous analysis. However, we also observe that the higher a participants' dispositional performance approach orientation the lower their enjoyment score is ($\beta = -0.32$). This result can again be explained by the finding that both tasks score high on climate assessment in the mastery direction. One could say that in general participants who are more dispositional performance approach oriented have a tendency to enjoy both activities less. In addition, we observed that the moderation of climate assessment in the performance direction on dispositional performance approach orientation has a positive effect on enjoyment ($\beta = 0.11$). This can be interpreted as: If the participant assesses the climate as more performance oriented and the participant is more dispositional performance approach oriented, the participant will enjoy the activity more, which supports our H_1. Unsurprisingly we only found this specific effect in the moderation between performance climate assessment and performance approach disposition. This is congruent with the findings from our manipulation check where we found that we were only able to activate a performance climate successfully, but were not able to activate a mastery climate.

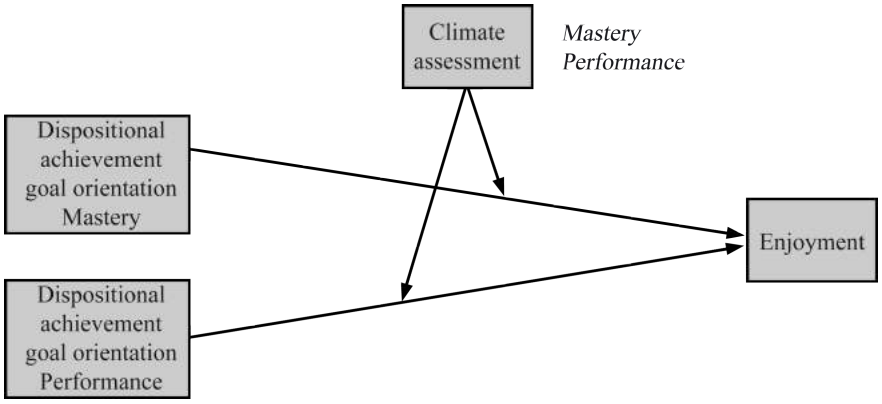

Figure 12. Model of climate assessment (per assessment type) moderating effects of disposition on enjoyment

Our second hypothesis stated that: *"We expect that when a mastery climate has been activated, participants enjoy the task better, than when a performance climate has been activated"*. Given that both activities were assessed as highly mastery oriented, we cannot directly derive from our data whether or not a mastery activity would indeed yield a higher enjoyment score. Leading us to neither refute nor confirm the hypothesis that more enjoyment is gained from a mastery activated activity as opposed to a performance activated activity. Nevertheless, we submitted the participants' enjoyment scores for the mastery activity ($M = .27$, $SD = .95$) and the performance activity ($M = .30$, $SD = .99$) to a paired samples t-test. This test presented no evidence in support

Table 5

Mixed effect multi level model with climate assessment as a moderator

Enjoyment	Coefficient	Std. Error	Z-value	p-value	95% Conf.	Interval
DAGO Mastery Approach	0.58	0.24	2.35	0.019	0.10	1.05
DAGO Performance Approach	−0.32	0.16	−2.01	0.045	−0.64	−0.01
Climate assessment Performance	−0.37	0.32	−1.16	0.244	−1.01	0.26
Climate assessment Mastery	0.85	0.31	2.77	0.006	0.25	1.45
DAGO Performance Approach ∗ Climate Assessment Performance	0.11	0.05	2.15	0.031	0.01	0.20
DAGO Mastery Approach ∗ Climate Assessment Performance	0.02	0.08	0.26	0.793	−0.13	0.17
DAGO Performance Approach ∗ Climate Assessment Mastery	0.02	0.05	0.49	0.625	−0.07	0.11
DAGO Mastery Approach ∗ Climate Assessment Mastery	−0.1	0.07	−1.37	0.172	−0.24	0.04

of our hypothesis. That is, results showed that both enjoyment scores are not significantly different from each other ($t(134) = 0.58$, $p = 0.56$, $d = .05$).

4.4 Explorative Statistics

We found that participants who won in the performance activity (i.e. ended up in first, or combined first place; $n = 32$, $M = .67$, $SD = .86$) rated enjoyment significantly higher as opposed to participants that did not win ($n = 103$, $M = .18$, $SD = 1.0$) in the performance activity ($t(133) = -2.47$, $p = 0.015$, $d = -.49$).

Also, we found that participants who were dominantly dispositionally mastery approach oriented (i.e. the participant choose consistently for mastery approach in a forced choice test; $n = 78$, $M = .3$, $SD = .89$) as opposed to participants which were not dominantly dispositionally mastery approach oriented ($n = 57$, $M = .22$, $SD = 1.02$) did not report higher enjoyment scores in the mastery activity ($t(133) = -0.48$, $p = 0.63$, $d = -.08$). In our sample, participants chose other dominant dispositional orientations more sparingly: performance approach ($n = 5$), performance avoidance ($n = 13$), mastery avoidance ($n = 15$) and no dominant achievement goal ($n = 24$). Comparison against other dominant dispositions would therefore render a distribution too skewed for reliable statistical analysis.

Furthermore, thematic analysis (Braun & Clarke, 2006) of the qualitative questionnaire gave us explorative insight in additional factors underlying enjoyment. Participants were asked whether they would like to participate again in one of the activities and if so, which activity. 68 participants (50.4%) responded that they would like to participate again (*mastery*: 28, 20.7 % ; *performance*: 40, 29.6%). 67 participants (49.6%) would rather not participate again. Reasons for not wanting to participate again include: *"the activity was no fun"* ($n = 21$, 31.3%), *"the activity was boring"* ($n = 15$, 22.4%), and *"the activity was exhausting"* ($n = 15$, 22.4%). Reasons for participating in

the *mastery* activity again included themes such as: *"the activity is directed at myself"* ($n = 10$, 35.7%), *"I can attempt to become better at this"* ($n = 8$, 28.6%), and *"this activity does not revolve around winning"* ($n = 4$, 14.3%). Reasons for participating in the *performance* activity again included themes such as: *"I like to measure myself against others"* ($n = 13$, 32.5%), *"I want to get the most out of myself"* ($n = 10$, 25%), and *"this activity gives the possibility to win"* ($n = 8$, 20%). One notable entry was given to the question what the participants would like to change in the activity: *"include fun elements"* ($n = 8$, 5.8%). A full overview of all themes can be found in Appendix H.

5 Discussion

In order to investigate the research question; " *What is the influence of activating a mastery climate versus a performance climate, and the dispositional goal (mastery to performance) of the participant on the participant's enjoyment of a target behaviour, in the context of PE class exercises?*", an experiment was conducted. Within this experiment participants took part in two activities during a PE lesson at their high school. Each activity was designed to activate either a mastery climate or a performance climate. All participants completed both activities and were asked to assess the perceived climate and enjoyment in both activities. Results showed that activation of a performance climate was successful, however activation of the mastery climate was found to be unsuccessful. A relation was found between disposition towards a performance approach achievement goal and enjoyment. Furthermore, a significant moderation of performance climate assessment on performance approach disposition was found, supporting our first hypothesis. However, no evidence was found to support nor refute the second hypothesis. We will discuss the findings for each hypothesis separately.

Our first hypothesis was that: *"We expect that participants' task enjoyment will be highest when there is a better fit between the activated achievement climate and the dispositional achievement goal orientation of a participant"*. Whilst our pre-test showed results in activating these specific climates, results of our experiment provided no evidence in support of our H_1. That is, dispositional achievement goal orientations moderated by condition type did not show an effect of condition type on enjoyment. In our manipulation check we found that activation of a performance climate was successful. That is, participants assessed the climate of the activity in which the performance climate was activated as more performance oriented as opposed to the activity in which the mastery climate was activated. Furthermore, we found that participants assessed both climates as equally mastery oriented. Results provided no evidence that there is a direct fit between activated achievement climate and dispositional achievement goal orientation. However, activation of an achievement goal climate, does not directly imply that a participant will assess that climate as mastery-, or performance oriented.

Therefore we argued that we should consider the influence of a participants' *assessment* of the achievement goal climate as a predictor. By adding climate assessment as a moderating effect to the model, results support our hypothesis. With this model we found that people who had a disposition towards a performance approaching orientation reported gaining less enjoyment from the activities. Which implies that people who are dispositionally performance approach oriented gain less enjoyment from either activity. However, this relation was moderated by the participants' performance climate assessment. That is, results showed that participants who scored higher on the dispositional performance approach orientation, and scored higher on the performance climate assessment, assessed the activities as more enjoyable. Our first hypothesis stated that a fit between the activated climate and the disposition of the participant would influence enjoyment in a task. However, since the climate assessment clearly showed that the activation only succeeded partially,

taking into the account the participants' assessment of the climate in our analysis allows us to still support our first hypothesis, albeit in one direction only.

Our second hypothesis stated that: *"We expect that when a mastery climate has been activated, participants enjoy the task better, than when a performance climate has been activated"*. Whilst literature did show evidence for this hypothesis, within our study we did not find any data supporting nor refuting the hypothesis. That is, analysis showed no difference between enjoyment scores for the mastery and performance activity. However, since our manipulation to activate the mastery climate did not have the desired effect it is possible that enjoyment scores would differ. Therefore, we cannot confirm nor refute our second hypothesis.

Whilst in the design of the experimental method a lot of care was taken to achieve a setup that manipulated the participants' environment, it is important to consider the effectiveness of the manipulation. A variety of reasons might explain why our manipulation of the motivational climate was ineffective. Firstly, to ensure minimal influences to enjoyment scores given by participants, the experimental conditions were kept as simple as possible. Therefore, both climate activations relied heavily on the spatial distribution of participants and visual feedback mechanisms in the Glowsteps and television screens. Whilst these components are proven to support activation of achievement goal climates (Ames, 1992; Epstein, 1988), the sole use of these components might not be distinguishable enough to activate a single climate. Also, the participants received instructions written in a performance or mastery activating manner. These instruction cards were evaluated by the participants mostly as: clear and precise. However, some participants evaluated them as long, boring and containing too much text, which might imply that the participant did not read the instruction card fully. Future research might therefore opt to use explanations which are more vividly supported or simply explained verbally by the researcher to maintain focus on the task at hand.

Due to the many different determinants of a motivational climate it is difficult to manipulate a climate specifically into one achievement goal direction. The TARGET framework attempts to group many of these determinants into one framework (Ames, 1992; Epstein, 1988). Therefore we used the components of the TARGET framework to activate the specific climates as much as possible. To check whether these manipulations to activation the specific climates had the desired effect we conducted a pre-test in which participants were asked to assess the climates of these activities. In this test we observed that our manipulations were successful. That is, all participants tended to appraise the performance climate as performance oriented, and 9 out of 12 participants specifically assessed the mastery activity as mastery oriented. The last 3 participants noted that both activities could be seen as mastery activities. However, our experiment took place during a PE-lesson in contrast to our pre-test. Which in general implies a mastery oriented climate, due to mastery of tasks being one of the main goals of PE in the Netherlands: "*Het vakgebied lichamelijke opvoeding heeft als doel dat leerlingen beter leren bewegen vanuit een pedagogisch perspectief. Ze moeten meer(voudig) bekwaam én enthousiast worden om nu en later deel te nemen aan de beweeg- en sportcultuur.*" (Translation: The main goal of PE lessons are to educate students how

to perform physical activity in a better way from a pedagogical perspective. The students need to become competent and enthusiastic to participate in the movement- and sportsculture, now and in the future.; Bax et al., 2017, p.11). One could hypothesise that a great deal of the climate is already set by existing context. In future studies, researchers would therefore do well by testing the experimental setups in exactly the same context that the experiment will take place in.

Also, in the experimental setup used, enjoyment and climate assessments were investigated in a within-subject manner over both activities. These conditions were tested right after each other, which unfortunately left room for participants to remember some of the answers given to the previous questionnaires and submit equal answers or to evaluate both scenario's more closely related to each other. We did attempt to counter this effect by randomising the questions in the questionnaire, however in future research it might be preferable to split the activities between two different PE lessons. In addition, we saw that during the experiment some of the participants did communicate with each other whilst filling out the questionnaires. The conversations were brief and participants were, when possible, corrected. Although we cannot guarantee that some of the answers might be influenced by the opinions of other participants.

Furthermore, whilst one school made participation mandatory as part of their curriculum, the researchers had no means of enforcing participation nor incentivising winning. Participants did not have a physical incentive to win (e.g. a price or a good grade) other than the gratification of winning. Although this physical incentive was absent from our experimental setup, our activation of the performance climate did work. Leading us to believe that social incentive in itself is enough basis to activate a performance climate. However, the effect might be stronger when a physical incentive is added. In contrast, the use of competition elements in PE lessons is still highly debated. Aggerholm, Standal, and Hordvik (2018) recently gave several arguments based on educational psychology and philosophy of sports, both in favour as well as against the usage of competition elements. Clearly defining 4 different levels, ranging from complete avoidance to acceptance as a vital part of PE. Whilst this subject matter does not directly influence our experimental setup, future research should keep in mind that these discussions are still very much relevant today. Potentially influencing the execution of an experiment through opinions of a PE teacher.

Lastly, we should recognise that enjoyment is quite a rich, and dynamic construct (Snyder & Lopez, 2002). Since enjoyment as a psycho-physiological response is quite hard to measure during exercise (Mandryk, Inkpen, & Calvert, 2006), the current study resorted to using retrospective questionnaires instead. To minimise influences of other factors the questionnaires to assess enjoyment were presented directly after the task, ensuring that the participants had as much recall of their emotions during the activity as possible. However a participants' current mood is possibly influenced by a variety of factors which in turn change the participants' assessment of enjoyment in the activity. A participant might have been pre-occupied with the memory of receiving a bad grade recently or was perhaps engulfed in the more enjoyable feeling of falling in love. Since both enjoyment assessments in the current study took place directly after each other the influences of other factors should be minimal. However, to get an even better understanding of enjoyment as-

sessment in an activity, future research could opt to have the same activity multiple times and as such assess enjoyment in a task over multiple different moments in time reducing the potential variance in enjoyment.

Furthermore, the current research leads to several societal implications. The current study suggests that activation of a motivational climate in PE lessons is possible. Which could when fitted correctly to an individuals' dispositional achievement goal orientation increase enjoyment in an activity. Leading to potentially more physical activity throughout an individuals' life (Trudeau & Shephard, 2005). Furthermore, increasing enjoyment supports one of the main goals of PE in the Netherlands (Bax et al., 2017, p.11). However, if we were to apply these climate activations to PE lessons, we should consider the ethical perspective as well. Whilst it might be positive to increase enjoyment by activation of a motivational climate in PE lessons. One should consider that if these activations became part of the day-to-day routine in PE lessons they might result in additional effort required from the PE teacher. Thus decreasing the time of this teacher to help out individual students. Furthermore, the impact of increasing competition elements, or activating a performance climate, should not be taken lightly. Currently there are many differing opinions on the subject (Aggerholm et al., 2018). This suggests that effects of activating a performance climate might differ per context and individual. We should therefore consider when and where these activations are appropriate instead of degenerative to a PE lesson.

5.1 Design Considerations

Whilst designing the manipulations to activate the mastery or performance climates several different models were used and their effectiveness were subjectively evaluated by the researchers. The design was tested using a pre-test to evaluate whether the test had the desired effect. We will provide some considerations for future studies that might aid researchers in creating other climate activations. In order to generate a more comprehensive picture of our design we will use the illustration in Figure 13 to guide our narrative.

Within our design we made use of the TARGET framework (Task, Authority, Recognition, Grouping, Evaluation and Time; Ames, 1992; Epstein, 1987). Each of these components influences how the participant evaluates the motivational climate. We will provide a short explanation of them individually:

Task. Differences in task description and goal of the task (e.g. winning or self-improvement).

Authority. Which stimuli the teachers provides before and during the task (e.g. explaining that only winning is important or providing tips on how to improve).

Recognition. Providing appraisal for the progress a student made and treating all students equally.

Grouping. The manner in which groups are formed (e.g. are the members equally skilled? Is teamwork encouraged?).

Evaluation. Is the progress of the individual evaluated according to their own goals? (e.g. is feedback provided in accordance to their individual level?).

Time. Is the time provided to accomplish certain goals matched to the individual? (e.g. providing

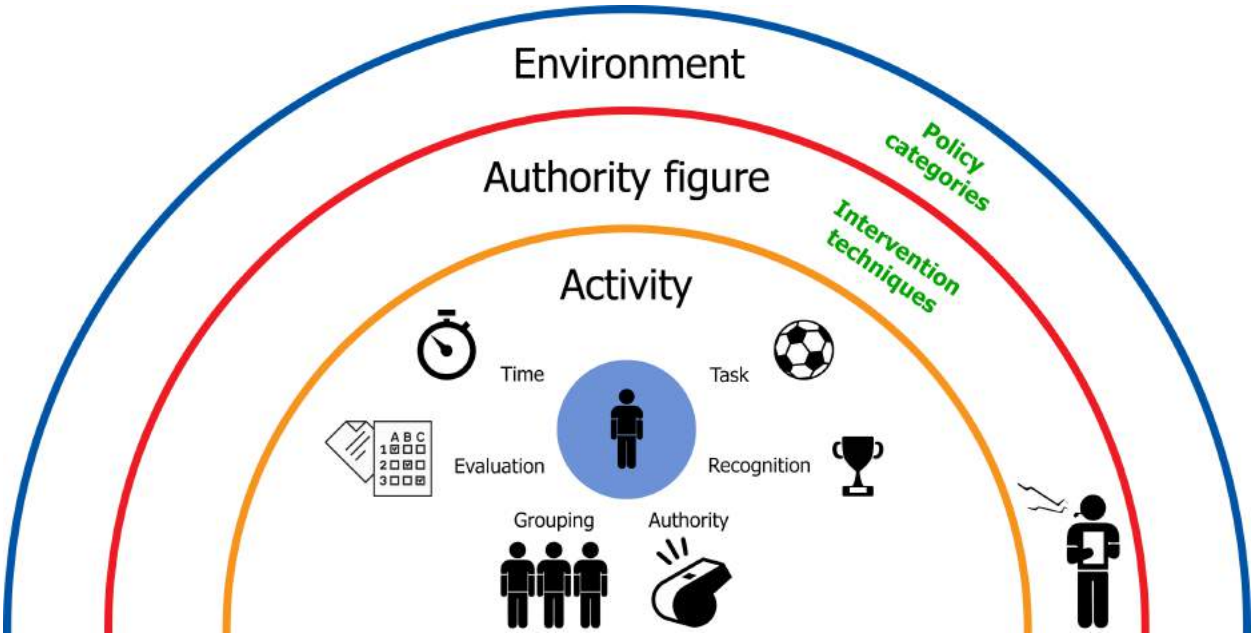

Figure 13. Design Considerations Visualised

more time to students that learn slower.).
In our experimental design the authority figure was the researcher and explanation was done via an activity card presented on paper to minimise the possibility of the researcher influencing the climate with their explanation. Whilst ensuring that the explanations were exactly the same and precise. This might not have been the best solution as some valued the activity cards as boring and long. Providing a script for the PE teacher or experimenter might yield more interaction and would thus be potentially less boring.

In our design, we found that due to the simplified setup presenting feedback to the participant in a direct and concise manner was quite important. The Glowsteps made use of coloured light flashes to indicate whether a participant was on time or too late and also, whether the Glowstep registered the step at all. In some of the many small trial runs we saw that the tester did not see any visual feedback from the Glowstep if it was not present when the tester was roughly 2-3 meters away from the Glowstep. These problems were solved by allowing the Glowstep to blink in accordance to the time left (e.g. 50% of the time left meant 1 flash per second whilst, $< 10\%$ of the time left meant 3 flashes per second). This additionally allowed participants to evaluate whether their current speed was equal to the speed of the previous rounds.

The television screens that provided the participants of the performance activity with feedback regarding their current position relative to others were not entirely salient either. Whilst the ranking itself (e.g. first place, 3rd place, etc.) was clear, the time differences between these rankings were not salient enough during the activity. A moment of *recognition* was however still present, since participants often went straight to the television screens right after the activity to *evaluate* their own time and often praise the winner.

In addition to the elements of the TARGET framework in Figure 13 we observe several gaps, namely: activity, authority figure and environment. Although designing an activity in accordance to the TARGET framework can greatly help activate the right motivational climate, it is not an all-encompassing framework. Whilst we do not present scientific evidence to support the existence of such gaps, we found that it helped tremendously to consider the existence of three stacked gaps. The first one is the environment, such as the school or PE lesson in which the activity takes place which greatly differs from for example soccer practice in which becoming better and raising your own level is often the true goal. Secondly, there is the authority figure gap (e.g. the PE teacher or experimenter) and lastly, we have the activity gap, which has been our primary focus for most of the design. We would hypothesise that the authority figure has a great influence to both the activity as well as the environment. The components in the TARGET framework can be considered as some of the tools which the authority figure can utilise to influence the perceived climate. We know from the TARGET framework that the activity influences the assessed motivational climate. Also, we know that an authority figure has a lot of influence on the motivational climate (Roberts & Treasure, 2003; Smith, Smoll, & Cumming, 2009; Treasure & Roberts, 2001). And lastly, one can clearly imagine that the environment has a lot of influence on the assessment of a motivational climate. All three gaps influence each other, which becomes more visible by example. If a PE teachers provides a task such as the traditional Shuttle Run, this task can be either appraised as performance or mastery oriented. As one can either compare themselves against other students, or against their previous scores. The authority figure (PE-teacher) has the option to change the setup in such a way that the scores themselves do not necessarily matter, but rather praise the students that attempt the run again. Moreover, the PE-teacher has the option to change the environment by asking students to cheer on their fellow students and thus utilising the environment itself to create a motivational climate. In extension to the COM-B model discussed in the introduction of this thesis, the Behaviour Change Wheel by Michie et al. (2013, 2011) extends the COM-B model with suggestions on how to influence behaviours of people on intervention- and policy level (see Figure 14). Michie et al. (2011) devised this model to aid policy makers in selecting the right kind of intervention and policy level. This model could serve as basis for future research to find additional ways to intervene in a PE lesson.

Lastly, one should keep in mind, that whilst models tend to describe lots of factors that influence a certain achievement goal climate, these factors are not all-encompassing. For example, the novelty of a manipulation can already influence the assessment of a participant. Pre-tests and repeated measurements are splendid ways to gauge your design and minimise influencers.

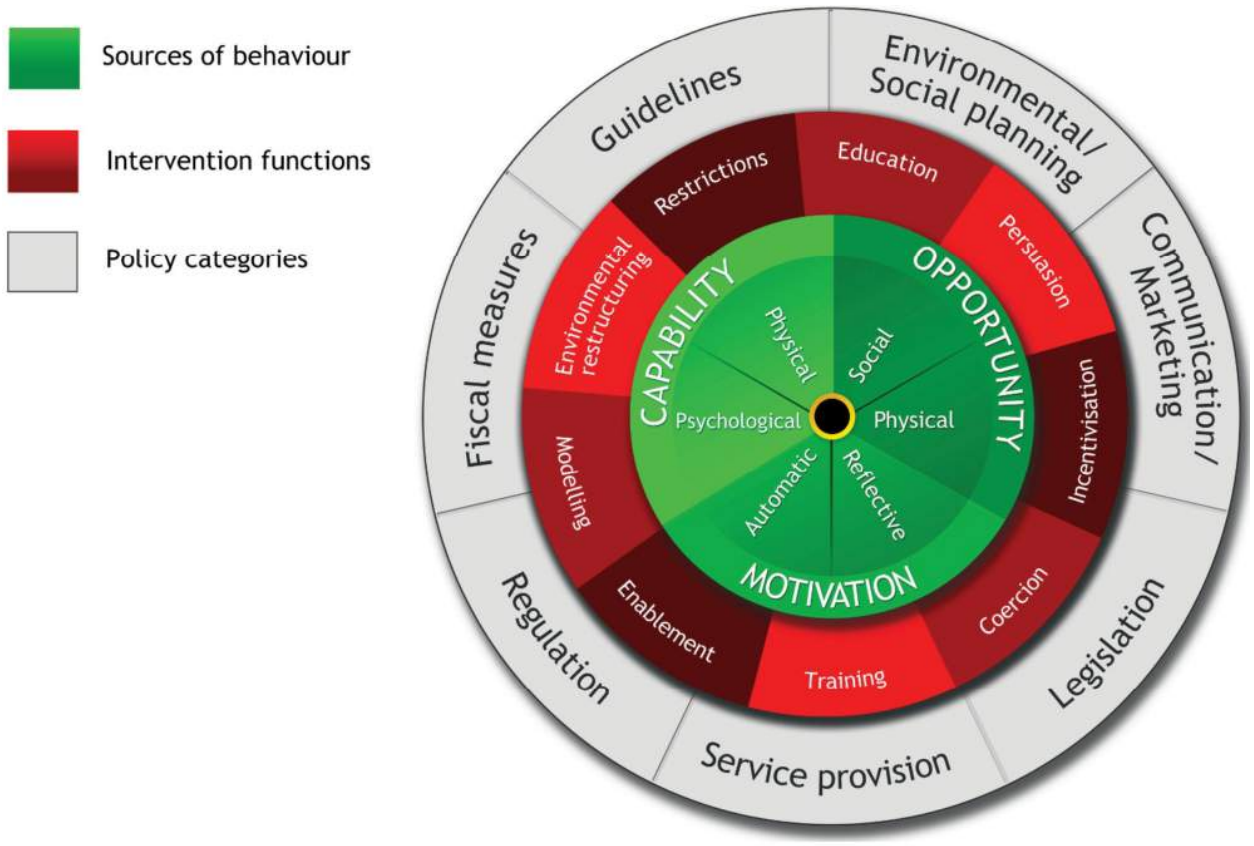

Figure 14. Behaviour Change Wheel Framework (Michie et al., 2011)

5.2 Conclusion

Results showed that enjoyment of a participant was higher when the participant's climate assessment matched their dispositional achievement goal orientation. However, this effect was only found for the activation of the performance climate. A likely reason for this is that the activation of the mastery climate did not succeed. Despite this failed activation, these results do seem to support our first hypothesis that activation of an achievement goal climate which fits the participants' dispositional achievement goal orientation leads to more enjoyment in an activity. This is in line with research done by Bortoli et al. (2009). Furthermore, we found no evidence to either support or refute our second hypothesis that more enjoyment is gained from an activity which is mastery oriented as opposed to an activity which is performance oriented, since our designs to activate a mastery or performance climate only succeeded for the activation of performance. Whilst first results suggest a link between climate and disposition, further research into these effects with a manipulation design that ensures the correct climate activation is needed to confirm whether these links truly exist. If future research gathers comparable conclusions, enjoyment of various activities (e.g. PE lessons) might be increased.

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Appendix A Glowstep Hardware & Programming Libraries

This appendix contains all hardware and software used in or before the experiment.

Hardware

The Glowsteps consist of the following components

- Microcontroller ATMega 2560V;
- LED driver board Flowsteps 2.0 (3x; 6 LED's per module);
- Capacitive pressure sensors (3x);
- Sparkfun Triple axis accelerometer breakout board (MMA7361);
- Sparkfun Audio-Sound breakout board;
- Speaker;
- Battery pack;
- Main PCB;
- XBee Radio Module (1 mW).

Software

Arduino version 1.8.5 was used to create the code compiled into the ATMega2560V chip, the following libraries were used to support this program: Animation, Calculate, CctLamp, ColorLamp, LED, WTV020SD Driessens, XBee GlowStep short and GS Struct Data.

Processing (version 3.3.6) was used to capture incoming transmissions of the Glowsteps and transfer them to a MySQL database. This Processing code used the libraries: Serial (processing), SimpleDateFormat (Java), DateFormat (Java), Date (Java), SQL (Bezier) & SQL Mapper (Bezier). PuTTY 0.65 and Coolterm 1.5.0 were used for debugging purposes. The database was accessible via a console panel created for this experiment and was only accessible locally.

The television screens in the performance condition showed a website programmed in PHP, HTML5 & CSS. This website ran locally on a laptop on WAMP Server 3.1.0 64-bit (Windows, Apache, MySQL & PHP; http://www.wampserver.com/en/). Running: Apache 2.4.27, PHP 5.6.31 and MySQL 5.7.19.

Appendix B Study Procedure

Pre-questionnaire

When 1 week before the experiment
What Questionnaire 1, id attachments and a small introduction
Time 15 minutes
Materials paper questionnaires (150% in case of incorrect writing), pens, deliver box (closed)

Checklist

- [**vooraf**] deelnemers invoeren in AGT-Fit;
- [**vooraf**] nummers invullen op questionnaires, namen op post-its erop (geen subgroups, enkel ids);
- Vragenlijsten + pennen klaarleggen;
- Inleverdoos klaarzetten;

Introduction
Ik ben Ruud Wijffelaars, student Human Technology Interaction aan de TU in Eindhoven. Hebben jullie je wel eens afgevraagd waarom je meedoet aan gym, en wat je aan gymmen leuk vind? Ik doe daar onderzoek naar en ook kijk ik hoe je moderne techniek in gymlessen kan gebruiken.

Volgende week gaan jullie meedoen aan mijn onderzoek. We gaan dan wat eenvoudige activiteiten doen. Ik vertel daar volgende week meer over. Vandaag al wil ik jullie vragen een vragenlijst in te vullen. Maar eerst nog even de toestemmingsformulieren. [*ophalen toestemmingsformulieren*] Bedankt.

De vragenlijsten liggen hier opzij, op de vragenlijst zit een post-it met je naam. Je doet aan dit onderzoek helemaal anoniem mee. Dit betekend dat op het einde ik niet weet van wie welke antwoorden zijn. Ook wordt je absoluut niet beoordeeld in dit onderzoek. Je krijgt geen cijfer, en jullie docent krijgt jullie antwoorden niet te zien. Beantwoord alle vragen voor jezelf, afkijken of overleggen met je vrienden heeft geen zin, want de antwoorden gaan alleen over jou. Denk niet teveel na over wat je antwoord.

Als jullie klaar zijn met de vragenlijst, dan mag je de pen en de vragenlijst in deze doos inleveren en verder gaan met de gymles van jullie docent(e).

Succes. [*uitdelen vragenlijst 1*]

Questionnaire(s)

- Dispositional Achievement Goal: Levels and Dominant;
- PACES (*aimed at current Gym Class*);
- [**pre-gathered**] Gender / Age / Classroom & id.

id attachment Each participant that does the questionnaire is entered into the AGT-Fit database. The id created will be entered on the questionnaire. A post-it with the name of the participant makes sure that the right questionnaire ends up with the right person.

Experiment

When The experiment
What Small introduction, experiment (questionnaires in between), post-questionnaire.
Time 50 minutes
Materials Glowsteps (charged!), Laptops (2x), Camera + wide angle lens, Stopwatch, television (2x) + mounts, power cables, Chromecasts (2x), Megafoon (as salient alarm), XBee connection to laptop (2x), Questionnaires (n * 3 * 150%), Deliverbox;

Keep in mind

- Data needs to be complete and readily available! (id division, printed lists, etc.);
- Glowsteps need to be activated +/- 30 mins upfront (due to calibration)!

Checklist

- [**vooraf**] questionnaires printen, post-its met namen plakken;
- [**vooraf**] participanten opdelen in subgroepen en invoeren in AGT-Fit;
- [**vooraf**] stickers printen;
- Glowsteps Mastery (30 min kalibratie);
- Glowstep nummers Mastery;
- Glowsteps Performance (30 min kalibratie);
- Glowstep nummers Performance;
- Laptop 1;
- Laptop 2;
- Televisie 1 + Chromecast (op kast);
- Televisie 2 + Chromecast (op kast);

- Hotspot verbinding aan;
- Verbinding Laptop 1 ¡-¿ 2 testen;
- Camera + breedhoeklens in basketbalpaal;
- Pionnen op alle hoeken (2x 4);
- Questionnaire pakketjes 2a, 2b en 3 klaarleggen voor gebruik (met pennen);
- Televisie schermen op AGT-Screen;
- Klaarleggen activiteitenkaarten (Mastery & Performance);
- [**Repetitive**] Subgroepen dubbel checken in AGT-Fit;
- [**Repetitive**] Glowsteps in Demo modus zetten;

1. Distribute Glowsteps according to scheme and power on (if time is short, power on the Glowsteps beforehand, and leave them on the floor (calibration));

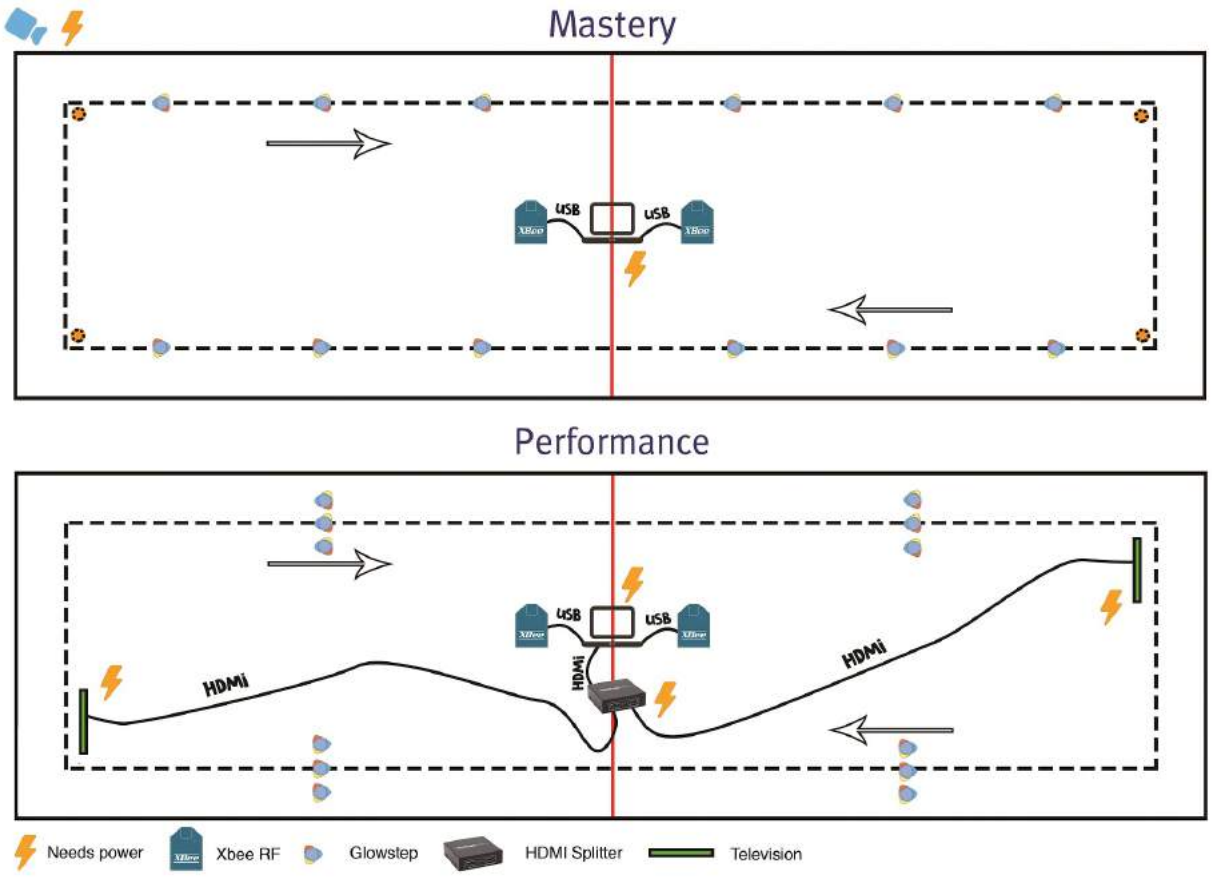

Figure 15. Schematics of activities A (Mastery) and B (Performance)

2. Setup two screens;
3. Lay power lines to two laptops and screens;
4. Lay video cables from laptops to screens and check connections;
5. Setup video camera with wide angle lens;
6. Ensure the correct subgroups are activated in the console according to scheme:

Sessions	1	2	3		
	Mastery	Performance	Questionnaires	Nothing	Time
Round 1	A	B		C	8
Round 2	C		A, B		8
Round 3	B	A	C		8
Round 4		C	A, B		8
Round 5			C	A, B	8
					40
If class is <= 24 students					
Sessions	1	2			
	Mastery	Performance	Questionnaires	Time	
Round 1	A	B		8	
Round 2			A, B	8	
Round 3	B	A		8	
Round 4			A, B	8	
				32	

Figure 16. Overview of starting times per subgroup

7. (paper) stickers with id division;
8. (paper) questionnaires during and post-experiment;
9. (paper) Activity cards (1 per person, laminated).

Introduction

Hallo, jullie kennen mij als het goed is van de vragenlijsten van afgelopen week. Vandaag gaan we aan de slag met het daadwerkelijke onderzoek. Hiervoor worden jullie in groepen gesplitst; Aangezien ik jullie verder niet ken, is de indeling die gemaakt is compleet willekeurig. Iedereen krijgt zometeen een sticker waarop je groep staat en twee nummers. Op deze manier weet je in welke groep je zit en waar je straks moet starten.

OK. We gaan zo beginnen. Iedereen gaat zometeen twee activiteiten doen.

3 groepen - Aangezien er 2 activiteiten zijn en 3 groepen zullen er in de eerste en laatste ronde groepen even niets te doen hebben. Tijdens deze momenten is het de bedoeling dat je (in de kleedkamer wacht / de activiteit van de docent volgt / ?).

2 groepen - Er zijn twee activiteiten en 2 groepen, dit sluit dus mooi op elkaar aan.

Bij de start en aan het einde van de rondes zullen we dit laten weten. Je start of stopt dan met de activiteit. Bij het einde van de eerste activiteit pak je de vragenlijst bij je eigen naam vanaf de tafel (grond, etc.) en vul je deze in (3 groepen - in de kleedkamer, ...) Als je klaar bent met het invullen van de vragenlijst lever je deze in, in de inleverbox. Alles wat jullie invullen op de vragenlijst zal net zoals vorige week volledig anoniem behandeld worden. Dit betekent dat de leerkracht niet weet wie wat heeft ingevuld en dat je ook op geen enkele manier beoordeeld wordt met een cijfer.

2 groepen - loop nu naar de volgende activiteit op je sticker en begin met het lezen van de activiteitenkaart.
3 groepen - (wacht in de kleedkamer, ga nu naar de activiteit van de docent.)

Experiment
Activity A - Mastery
Student starts at a Glowstep — Glowstep blinks blue in walking direction;
Student steps on the Glowstep — Glowstep turns Blue;
Student runs a round and steps again — Glowstep sends and records time, Glowstep flashes yellow in accordance to time left;
n-th) Another round — Glowstep sends and records time;
Time < previous? - Glowstep stays green;
Time > previous? - Glowstep is red (time passed) and time resets to first time.

Activity B - Performance
Student starts at a Glowstep — Glowstep blinks yellow in walking direction;
Student steps on the Glowstep — Glowstep turns Blue;
Student runs a round and steps again — Glowstep sends and records time - Screens update showing fastest students;
n-th) Another round — Glowstep sends and records time - Screens update showing fastest students; Fastest time gets send to the Glowsteps and turns red when this time has elapsed.

Questionnaires - PACES (Motl et al., 2001; Ven, 2016);

- Assessment of Achievement Climate (Mastery or Performance) (Weeldenburg, 2017);
- High scores (directly from data).

Post-experiment

- Note down the measurement of the gym room + lap measurements;
- Back-up video data;
- Back-up high scores & database;
- Scan questionnaires.

Appendix C Pre-questionnaire

Questionnaire was taken one week before the experiment. Questionnaire also included the age, school year and participant number pre-printed to ensure matching of data between the questionnaires.

Introductie
Hartstikke bedankt dat jullie de tijd willen nemen om mee te doen met dit onderzoek. Deze vragenlijst gaat over het vak L.O. (of gymles). Vanuit de Technische Universiteit Eindhoven zijn we benieuwd of we gymlessen leuker of uitdagender kunnen maken, en daar hebben we jullie hulp bij nodig. Daarom vragen we jullie deze vragenlijst in te vullen.

De vragenlijst gaat over alle lessen L.O. die je tot nu toe hebt gehad op de middelbare school. Dus vanaf het begin van de 1e klas tot en met nu. Probeer met die gedachte de vragenlijst in te vullen. Het gaat dus NIET over de afgelopen weken, maar alle lessen L.O. die je tot nu toe hebt gehad.

Er zijn geen goede of foute antwoorden! Het gaat er om hoe JIJ over de L.O.-lessen denkt of wat JIJ daar van vindt. Het heeft dus ook geen zin om met anderen te overleggen of om af te kijken. Deze vragenlijst is anoniem, wel staat er een deelnemersnummer op dit formulier dat persoonlijk van jou is, hiermee kunnen de gegevens gekoppeld en vergeleken worden. Je kunt dus eerlijk je mening geven en overal eerlijk antwoorden. Probeer bij elke vraag een antwoord te geven, ook als je twijfelt.

Mocht je vragen hebben tijdens het invullen van de vragenlijst, dan kun je altijd je vinger opsteken. Succes met invullen en hartstikke bedankt!

Ruud Wijffelaars

Deel A (5-pt. Likert-scale; Absoluut niet - Absoluut wel)
Hieronder staan enkele stellingen, iedere stelling start met de zin: **over het algemeen...**. Omcirkel bij iedere stelling een getal in hoeverre je denkt dat deze stelling voor jou klopt (1 = absoluut niet; 5 = absoluut wel). Heb je een fout gemaakt? Kras het antwoord dan door en omcirkel het juiste antwoord. Denk vooral niet teveel na over je antwoorden.

Over het algemeen...
1. wil ik zoveel mogelijk leren in de gymles.
2. ben ik vaak bezorgd dat ik niet alles wat er in de gymles wordt aangeboden kan leren.
3. wil ik in de gymles voorkomen dat dingen mislukken.
4. is het voor mij belangrijk om het beter te doen dan andere leerlingen in de gymles.

5. ben ik soms bang dat ik bepaalde dingen in de gymles niet zo goed kan leren als ik zou willen.
6. wil ik de oefeningen die we in de gymles krijgen aangeboden zo goed mogelijk leren uitvoeren.
7. maak ik me in de gymles zorgen dat ik slecht presteer.
8. is mijn doel in de gymles om beter te presteren dan andere leerlingen.
9. maak ik me zorgen dat ik misschien niet alles kan leren wat er in de gymles wordt aangeboden.
10. is het voor mij belangrijk om nieuwe dingen te leren in de gymles, zo goed als mogelijk.
11. is het voor mij belangrijk om het in de gymles goed te doen in vergelijking met andere leerlingen.
12. is mijn doel in de gymles om te voorkomen dat ik slecht presteer.

Deel B (7-pt. Likert-scale; Absoluut niet - Absoluut wel)
Deel B van de vragenlijst bestaat uit 2 onderdelen. De eerste 4 vragen zijn vergelijkbaar met Deel A, alleen start iedere stelling nu met: **Mijn doel in gymles is het...**. Het gaat hier dus over jouw persoonlijke doel. Ook kun je nu kiezen uit de cijfers 1-7 (1 = absoluut niet; 7 = absoluut wel).

Mijn doel in gymles is het...
1. ...beter te doen dan anderen.
2. ...niet slechter te doen dan anderen.
3. ...beter te doen dan vroeger.
4. ...niet slechter te doen dan voorheen.

In het tweede onderdeel hieronder staan 6 stellingen. Iedere stelling start met de zin: **Mijn belangrijkste doel in gymles is het...** Hier moet je een keuze maken tussen A of B. Omcirkel de letter bij de stelling die het beste bij je past. Heb je het foute antwoord omcirkelt? Kras deze dan door en omcirkel het juiste antwoord.

Mijn belangrijkste doel in gymles is het...

1.	A ...beter te doen dan anderen.	B ...niet slechter te doen dan anderen.
2.	A ...beter te doen dan voorheen.	B ...niet slechter te doen dan voorheen.
3.	A ...beter te doen dan anderen.	B ...beter te doen dan voorheen.
4.	A ...niet slechter te doen dan voorheen.	B ...niet slechter te doen dan anderen.
5.	A ...niet slechter te doen dan anderen.	B ...beter te doen dan voorheen.
6.	A ...niet slechter te doen dan voorheen.	B ...beter te doen dan anderen.

Appendix D Climate assessment and Enjoyment questionnaire

Questionnaire was taken twice during the experiment after each activity. Questionnaire also included the age, school year and participant number pre-printed to ensure matching of data between the questionnaires.

Introductie
Deze vragenlijst gaat over **de activiteit die je zojuist hebt gedaan**. Probeer met die gedachte de vragenlijst in te vullen. Het gaat dus ALLEEN over de activiteit van zojuist. Er zijn geen goede of foute antwoorden! Het gaat er om hoe JIJ over de laatste activiteit denkt of wat JIJ daar van vindt. Het heeft dus ook geen zin om met anderen te overleggen of om af te kijken. Deze vragenlijst is anoniem, wel staat er een deelnemersnummer op dit formulier dat persoonlijk van jou is, hiermee kunnen de gegevens gekoppeld en vergeleken worden. Je kunt dus eerlijk je mening geven en overal eerlijk antwoorden. Probeer bij elke vraag een antwoord te geven, ook als je twijfelt.

Mocht je vragen hebben tijdens het invullen van de vragenlijst, dan kun je altijd je vinger opsteken.

Deel A (5-pt. Likert-scale; Helemaal mee oneens - Helemaal mee eens)
Hieronder staan enkele stellingen, iedere stelling begint met: **Als ik in de les L.O. een activiteit mag doen zoals de laatste activiteit, ...** Geef bij elke stelling aan in hoeverre dit voor jou geldt (1 = helemaal mee oneens; 5 = helemaal mee eens). Als je een verkeerd antwoord hebt omcirkelt dan kras je die door en omcirkel je het juiste antwoord.

Als ik in de les L.O. een activiteit mag doen zoals de laatste activiteit, ...
1. dan vind ik dat leuk.
2. dan geeft me dat een goed gevoel.
3. dan houd ik daar niet van.
4. dan vind ik het plezierig.
5. dan is dat helemaal niet leuk.
6. dan geeft me dat energie.
7. dan word ik daar verdrietig van.
8. dan vind ik dat heel prettig.
9. dan voelt mijn lichaam zich goed.
10. dan vind ik dat saai.
11. dan wordt ik daar blij van.
12. dan vind ik dat heel vervelend.
13. dan vind ik daar helemaal niets aan.
14. dan voel ik me tevreden.
15. dan voelt dat goed.

16. dan zou ik liever iets anders gaan doen.
17. dan voel ik me wel eens onzeker.
18. dan schaam ik me wel eens voor mezelf.

Deel B (5-pt. Likert-scale; Absoluut niet - Absoluut wel)
Hieronder staan enkele stellingen, iedere stelling start met de zin: **In de afgelopen activiteit...**. Geef bij elke stelling aan in hoeverre dit voor jou klopt (1 = absoluut niet; 5 = absoluut wel). Denk hierbij alleen na over **de laatste activiteit die je gedaan hebt**.

In de afgelopen activiteit...
1. was winnen het belangrijkste.
2. werd er minder tijd besteed aan leerlingen die niet zo goed zijn in gym.
3. was het heel duidelijk wie de beste in de groep zijn.
4. was er de meeste aandacht voor de beste leerlingen.
5. moedigde de activiteit aan om beter te zijn dan je klasgenoten.
6. moedigde de activiteit aan om nieuwe dingen te leren.
7. moedigde de activiteit aan om elkaar te helpen om beter te worden.
8. was het vooral belangrijk, dat je je best deed.
9. moedigde de activiteit aan om elkaar te helpen iets te leren.
10. was iedereen even belangrijk.
11. was ik bang iets fout te doen.
12. hield ik mij meer bezig met de anderen dan mijzelf.

Appendix E Closing questionnaire

Questionnaire was taken directly after the experiment. Questionnaire also included the age, school year and participant number pre-printed to ensure matching of data between the questionnaires.

Introductie

Deze vragenlijst gaat over **het gehele onderzoek** waar je zojuist aan hebt meegedaan. Probeer met die gedachte de vragenlijst in te vullen. Er zijn geen goede of foute antwoorden! Het gaat er om hoe JIJ over de activiteiten denkt of wat JIJ daar van vindt. Het heeft dus ook geen zin om met anderen te overleggen of om af te kijken. Deze vragenlijst is anoniem, wel staat er een deelnemersnummer op dit formulier dat persoonlijk van jou is, hiermee kunnen de gegevens gekoppeld en vergeleken worden. Je kunt dus eerlijk je mening geven en overal eerlijk antwoorden. Probeer bij elke vraag een antwoord te geven, ook als je twijfelt. Mocht je vragen hebben tijdens het invullen van de vragenlijst, dan kun je altijd je vinger opsteken.

Open vragen

1. Wat doe je nog meer aan sport / beweging / hobbys buiten gymlessen op school?

2. Zou je nog eens willen deelnemen aan n van deze activiteiten en welke zou dat dan zijn?
(*kruis het juiste antwoord aan en vertel waarom je specifiek deze activiteit nogmaals zou willen*)

Ik zou graag... O Activiteit 1, O Activiteit 2, O Geen van de activiteiten nog eens willen doen
Omdat...

3. Als je iets mocht veranderen aan de activiteiten, wat zou dat dan zijn?

4. Wat vond je van de uitleg op de kaarten?

5. Wanneer haal jij plezier uit een gymles?

Appendix F XBee Settings

The table below includes the default settings per XBee radio module. For those devices in which the settings differed from the default it is noted down in the latter tables. All XBee's operated on a baud rate of 38400.

Table 6

General settings per XBee

Set	v	Set	v	Set	v	Set	v	Set	v
SH	13A200	**SL**	(per device)	**MM**	0	**RN**	0	**NT**	19
NO	0	**SC**	1FFE	**SD**	4	**A1**	0	**A2**	5
AI	0	**EE**	0	**KY**		**PL**	4	**CA**	2C
SM	0	**ST**	1388	**SP**	0	**DP**	3E8	**SO**	0
NB	0	**RO**	3	**D8**	0	**D7**	1	**D6**	0
D5	1	**D4**	0	**D3**	0	**D2**	0	**D1**	0
D0	0	**PR**	FF	**IU**	1	**IT**	1	**IC**	0
IR	0	**P0**	1	**P1**	0	**PT**	FF	**RP**	28
IA	FFFFFFFFFFFFFFFF	**T0**	FF	**T1**	FF	**T2**	FF	**T3**	FF
T4	FF	**T5**	FF	**T6**	FF	**T7**	FF	**VR**	10EF
HV	184E	**DB**	0	**EC**	0	**EA**	0	**DD**	10000
CT	64	**GT**	3E8	**CC**	2B				

Table 7

Differing settings per XBee

Setting	Mastery coord.	Performance coord.	Mastery End-p.	Performance End-p.
CH	12 / 13	14 / 15	12 / 13	14 / 15
ID	2222 / 3333	4444 / 5555	2222 / 3333	4444 / 5555
DH	0	0	13A200	13A200
DL	FFFF	FFFF	4054CB42 / 4151508A	403A7B9F / 40539EDE
MY	0	0	[D-18]	[1-C]
RR	0	0	6	6
CE	1	1	0	0
NI	masteryMaster	performanceMaster	`GS_ID_Mastery`*	`GS_ID_Performance`*
BD	5	5	5	5
AP	1	1	1	1

** ID is replaced with the decimal value of MY per XBee End-point*

Appendix G Activity Cards

TU/e Technische Universiteit Eindhoven University of Technology

Activiteit A

Volg onderstaande stappen nauwkeurig; zijn er vragen? Kom dan naar de onderzoeker (Ruud).

Doel

Deze activiteit is ervoor om je te helpen in het opbouwen van de snelheid waarmee je rent (net zoals de shuttle run). Deze activiteit draait alleen om jezelf, of anderen sneller of langzamer rennen dan jij, maakt dus niets uit. Probeer iedere ronde de snelheid van je rondje iets te verhogen. Lukt dat een rondje niet? Dan hersteld de tijd zich naar de tijd van je eerste rondje en start je opnieuw met opbouwen in een rustig tempo.

Stappen

1. Je zoekt dadelijk jouw eigen Glowstep op, deze is aangegeven met een nummer bij de letter A op de sticker die je gekregen hebt. De Glowstep knippert **blauw** in de richting waarin je zo gaat lopen.

2. Zodra het startsignaal klinkt, stap je de eerste keer jouw Glowstep. De Glowstep wordt nu **blauw** in kleur, aangezien dit de eerste ronde is.
3. Start met een **rustig tempo** dat je heel lang kan volhouden.
4. Na het eerste rondje stap je weer op **jouw Glowstep**. De Glowstep wordt nu groen en begint af te tellen.

Jouw doel is vanaf nu om ieder rondje net iets sneller te lopen dan de vorige. De tijd die je doet over jouw rondje wordt jouw nieuwe tijd om te verslaan, hoeveel sneller je loopt, mag je helemaal zelf bepalen, maar probeer wel steeds een klein beetje op te bouwen.

Dit betekend dat als je op jouw Glowstep stapt en deze is:

- Groen? Mooi! Je bent netjes binnen de tijd en hebt een nieuwe tijd om te verslaan.

- Rood? Helaas! Je was net te laat, maar **blijf doorlopen** en stap alsnog op de Glowstep reset zichzelf automatisch zodat je weer langzaam kan opbouwen.
5. Na enkele minuten klinkt het eindsignaal, je mag nu stoppen.

Samenvatting

- Start in een rustig tempo!
- Probeer steeds een klein beetje sneller te lopen dan het vorige rondje;
- Haal je de tijd niet? Geen paniek, blijf doorlopen, je start gewoon opnieuw met opbouwen.

Versie 20180404

Figure 17. Activity Card of Mastery Activation

TU/e Technische Universiteit Eindhoven University of Technology

Activiteit B

Volg onderstaande stappen nauwkeurig; zijn er vragen? Kom dan naar de onderzoeker (Ruud).

Doel

Deze activiteit is een kleine competitie, waarbij we kijken wie er gemiddeld sneller is dan de rest. Des te dichter je bij de eerste plaats komt, des te beter. Het gaat hier om gemiddelde snelheden, **iedere ronde telt dus mee voor het totaal.**

Stappen

1. Je zoekt dadelijk jouw eigen Glowstep op, deze is aangegeven met een nummer bij de letter B op de sticker die je gekregen hebt. De Glowstep knippert **geel** in de richting waarin je gaat lopen.

2. Zodra het startsignaal klinkt, stap je de eerste keer op de Glowstep. De Glowstep wordt nu **blauw** in kleur en de tijd begint vanaf nu te tellen.

3. Iedere ronde worden de gemiddelde tijden op de beeldschermen afgebeeld. Hier kun je zien hoe hoog je staat en of je dus moet versnellen of kan afzwakken.

Heren				Dames			
1	Ruud	105.5 sec	4 Rondes	1	Jenny	98.5 sec	4 Rondes
2	Andre	-1 sec	---	2	Anouk	-0.25 sec	---
3	Joris	-6 sec	---	3	Jill	-6.25 sec	---
4	Jaap	-6.25 sec	---	4	Anne	-6.25 sec	---
5	Mendelevitsj	-8.5 sec	---	5	Tilde	-7.75 sec	---
6	Hans	-11.5 sec	---	6	Gwen	-17.5 sec	---

De Glowsteps volgen de tijden van de snelste dame/heer, deze zijn dus **groen** zolang je sneller bent als de eerste plek en worden **rood** zodra je langzamer bent. Iedere keer als je op de Glowstep stapt, herstelt deze zich naar **groen** tot je langzamer bent.

4. Na enkele minuten klinkt het eindsignaal, je mag nu stoppen.

Samenvatting

- De tijd start wanneer je voor het eerst op de Glowstep stapt;
- Probeer je tempo vol te houden, het gaat om de gemiddelde tijd;
- Houd de tijden en elkaar goed in de gaten om te weten hoe goed je scoort.

Versie 20180404

Figure 18. Activity Card of Performance Activation

Appendix H Themes Subjective Experiences Analysis

Table 8

Themes in subjective experiences, question 2

Group	Theme	Observations	% Relative	% Group
Performance	Meten ten opzichte van anderen	13	31.71%	9.49%
Performance	Het leuk is	11	26.83%	8.03%
Performance	Beste uit jezelf halen	10	24.39%	7.30%
Performance	Je kan / Ik wil winnen	8	19.51%	5.84%
Performance	Wedstrijd element	5	12.20%	3.65%
Performance	Activiteit leuker is (tov A)	2	4.88%	1.46%
Mastery	Gericht op jezelf	10	40.00%	7.30%
Mastery	Leer / verbeter element	8	32.00%	5.84%
Mastery	Niet om winnen gaat	4	16.00%	2.92%
Mastery	Het leuk is	3	12.00%	2.19%
Mastery	Niet slechter dan anderen	1	4.00%	0.73%
Mastery	Minder vermoeiend is	1	4.00%	0.73%
Geen	Niet leuk	21	30.88%	15.33%
Geen	Saai	15	22.06%	10.95%
Geen	Vermoeiend	15	22.06%	10.95%
Geen	Medische redenen	3	4.41%	2.19%
Geen	Liever andere activiteiten	2	2.94%	1.46%
Geen	Tekort aan skill	1	1.47%	0.73%
Geen	Eentoning / niet veranderlijk	1	1.47%	0.73%
Geen	Meer test dan sport	1	1.47%	0.73%
Geen	Sporten niet leuk vinden	1	1.47%	0.73%
Beide	Leuk vinden	3	100.00 %	2.19%
Beide	Wedstrijden	1	33.33%	0.73%
Beide	Eigen tijd leuk vinden	1	33.33%	0.73%

Table 9

Themes in subjective experiences, question 3

Theme	Observations	% Relative
Niks	49	35.77%
Iets anders	16	11.68%
Kortere tijdsduur	14	10.22%
Minder rennen	13	9.49%
Geen idee	10	7.30%
Geen ren activiteit	9	6.57%
Leuke (spel)elementen toevoegen	8	5.84%
Betere spattiring van steps	3	2.19%
Minder mensen	2	1.46%
Meer tijd tussen activiteiten	2	1.46%
Geen wedstrijd element	2	1.46%
Muziek toevoegen	2	1.46%
Meer wedstrijd	1	0.73%
Warming up	1	0.73%
Meer diversiteit	1	0.73%
Enkel snelste tijd tonen. niet gemiddeld	1	0.73%
Valsspelers straffen	1	0.73%
Verwijderen van duidelijke score aanduiding	1	0.73%
Geen vergelijking onder elkaar	1	0.73%
Herhaling van dezelfde activiteit voor vergelijking tussen beide activiteiten	1	0.73%
Zonder Glowsteps	1	0.73%

Table 10

Themes in subjective experiences, question 4

Theme	Observations	% Relative
Goed / fijn / netjes / perfect / prima	62	45.26%
Duidelijk / overzichtelijk / volledig	40	29.20%
Slecht / snapte het totaal niet	8	5.84%
Goed genoeg / duidelijk genoeg	7	5.11%
Ik begreep het niet helemaal	7	5.11%
Onduidelijk / onlogisch	6	4.38%
Saai / teveel tekst / te lang	6	4.38%
Handig	4	2.92%
Met uitleg mondeling beter	4	2.92%
Eigen tempo	2	1.46%
Las alleen de samenvatting	2	1.46%
Te korte tijd	2	1.46%
Overbodig door uitleg	1	0.73%
Niet nodig	1	0.73%
Lastig	1	0.73%
Niet fijn	1	0.73%

Table 11

Themes in subjective experiences, question 5

Theme	Observations	% Relative
Leuke dingen / activiteiten	58	42.34%
Specifieke sport	17	12.41%
Leren / bereiken	11	8.03%
Actief	10	7.30%
Samenwerken	10	7.30%
Uitdaging	8	5.84%
Goed in ben	8	5.84%
Geen idee	5	3.65%
Wedstrijd competitief	5	3.65%
Gezellig / sfeer	5	3.65%
Uitval / Gym niet leuk	4	2.92%
Vriend(en/innen)	3	2.19%
Iedereen mee doet	3	2.19%
Gelijke behandeling	3	2.19%
Goed voelen	2	1.46%
Niet deze activiteit	2	1.46%
Niet te serieus	1	0.73%
Diversiteit	2	1.46%
Vrienden helpen	1	0.73%
Niet klimmen	1	0.73%

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