



**Does Writing Down
Positive Self Talk – Self Reflection
Affect Reaction Time?**

- A laboratory experiment with young Swedish
athletes

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Sammanfattning

Syfte

Syftet med studien är att undersöka om positivt Self-talk (ST) och självreflektion (SR) i form av att skriva i en träningsdagbok kan påverka reaktionstiden hos unga idrottare.

Sker det förändringar i reaktionstid mellan första och andra gången testet genomförs?

Är det en skillnad i hur stora förändringar som sker i reaktionstid när positivt self-talk gruppen och självreflektionsgruppen jämförs med en kontrollgrupp?

Hur upplevde idrottarna uppgiften att skriva träningsdagbok?

Metod

Studien är ett randomiserat laboratorieexperiment och skillnader i reaktionstid kan enbart ses på gruppnivå. Deltagarna ($n=29$) bestod av både manliga och kvinnliga 16 åriga idrottare som randomiserades i två experimentgrupper och en kontrollgrupp. Kvinnor och män var jämt fördelade mellan grupperna. Först genomfördes två olika reaktionstest (Simple RT och 4choice RT) med hjälp av ett datorprogram för alla deltagare. Experimentgrupp 1 (EG 1) genomförde en intervention där de under en vecka fick skriva ned sitt eget positiva ST i samband med träning. Experimentgrupp 2 (EG2) två skrev under en vecka ner vad de kunde förbättra med sin träning och vilka konsekvenser dessa förändringar kunde leda till. Kontrollgruppen (CG) fick utöver sin träning skriva ner sitt TV-tittande som en placebo. Efter interventionen genomfördes ett eftertest av reaktionstid och en enkät delades ut där deltagarna fick svara på hur de upplevde dagboken och om de trodde den kunde ha effekt på deras prestation.

Resultat

Inom grupperna var det enbart EG 2 (de som tillämpade självreflektion) som hade en statistiskt signifikant förbättring av reaktionstid mellan det första och det andra testtillfället. Detta gällde både för Simple RT ($p=0.028$) och Choice RT ($p=0.018$). CG och EG 1 hade små förbättringar i RT mellan det första och andra testtillfället men inga som var statistiskt signifikanta. Gällande jämförelser mellan grupper fanns inga statistiskt säkerställda skillnader i förbättring mellan CG och EG 1.

I EG 2 fanns ingen skillnad i förbättrad RT jämfört med CG i simple RT dock återfanns en statistiskt säkerställd skillnad i Choice RT där EG 2 hade en större förbättring jämfört med CG ($p=0,003$). Gällande hur grupperna upplevde interventionen med träningsdagböcker var resultaten relativt lika i de olika grupperna. Generellt upplevde grupperna att dagboken kunde ha en liten effekt på prestation samt att dagboksskrivandet i sig inte var så givande. Intressant var att de som skrev ner vad de såg på TV upplevde att detta kunde påverka deras prestation lika mycket som de som skrev ner positivt ST eller SR.

Slutsats

I självreflektionsgruppen hade en statistiskt signifikant förbättring skett både inom gruppen och jämfört med en kontrollgrupp. Inga signifikanta skillnader återfanns i positivt ST gruppen. Resultaten tolkas utifrån teorier som Self-determination, information processing och förmågan att fokusera uppmärksamheten. Styrkor och svagheter behandlas och slutsatsen är att fler upprepade studier behövs för att stärka och förstå sambandet mellan positivt ST och SR kopplat till reaktionstid. Ska denna typ av dagbok föras in i en klubb eller ett lag bör designen göras om så att den blir mer omtyckt av idrottarna.

Abstract

Aim

The aim of this study is to evaluate if positive Self-talk (ST) or Self-Reflection (SR) by writing in a training diary can affect Reaction Time (RT) in young Swedish Athletes.

Does reaction time change between the pre-test and the post-tests?

Is there a difference in reaction time changes between groups when the positive ST group and the SR group are compared to the control group?

How did the athletes experience the intervention?

Experiment design

This study is a randomized laboratory experiment. It is a between subjects design and therefore differences will only be seen on a group level. The participants N=29 were male and female 16 year old athletes. They were randomized in to two experiment groups (EG 1, EG 2) and a control group (CG), males and females were evenly distributed between groups. First two different (RT) tests were conducted with a computer program for all participants (Simple RT and 4Choice RT). After this an intervention of positive ST (EG1) or SR (EG2) was conducted with the use of training diaries for one week. The CG wrote down their habits of watching TV and this was used as a placebo. A re-test of RT was conducted after the completion of the intervention. After this an inquiry was handed to the participants to address their thoughts about using the diary and if they believed it could affect their performance.

Results

EG2 was the only group that provided a statistically significant decrease in RT time compared to the pre-test in both simple RT ($p=0.028$) and choice ($p=0.018$). No statistical significant differences in RT were found in EG1 or in the CG when comparing pre-and post tests of both simple and choice RT.

Comparing between groups showed no statistical significant difference in improved RT between the CG and EG 1 in simple RT or in 4choice RT. A statistical significant difference in improved RT was found between CG and EG2 in choice RT ($p=0.003$) where the EG 2 had a statistical significant improvement in RT compared to the CG. Comparing simple RT no statistical significant differences was found between EG2 and CG.

The three groups experienced using the diary in a similar way. In general they found the diary intervention somewhat giving and believed that the diary could have a little affect on performance. Interesting to notice is that the participators that wrote down their TV habits believed this could have the same impact on performance as the participators writing down positive ST or SR.

Conclusions

A connection was found between strategies of SR an RT. These results are analyzed regarding the theoretical framework provided by Self-determination theory, information processing and focus of attention. Strength and weakness is discussed and the conclusion is that more and reproduced studies are needed to determine the connection between interventions positive ST, SR and RT. If a training diary would be used in a team or a club some modifications should be done to make them more meaningful for the athletes.

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1. Introduction

This study is about two strategies of sport psychology and its effect on performance. How can athletes affect their own performances with their thoughts? The aim is to investigate the possibility to affect reaction time with the use of positive Self Talk (ST) or Self-Reflection (SR).

Regarding sport psychology we have learned a lot more about the connection between mind and body. But perhaps the fairest way to describe the area today is to say that there is a consensus that you cannot come to a consensus about the effects of some of these interventions and there are areas that has not yet been addressed.

The use and benefits of sport psychology has been adopted by both trainers and athletes. A review article considering psychological preparation for Olympic Games (Gould and Maynard, 2009 p.1395) concludes that athletes should pay attention to mental preparation before sessions of practice or competition. The authors list a menu of psychology strategies and skills that has been connected to successful competition during the Olympic Games. And this list includes both strategies of Self-Talk (ST) and self-reflection (SR).

-“Think positive”! This is an advice that can be given to athletes before training, competitions or everyday challenges. One other method is to analyze one owns performances and learn from mistakes. This study is addressing these methods and if they lead to improved performance in reaction time (RT). The intervention has the form of a training diary that involves writing down positive ST or SR.

ST (in this experiment positive ST) can shortly be described as a conversation to one self. Every time you are aware of your own thoughts; you are in a way talking to yourself. This includes both words (that other people can hear even if they are directed to yourself) and thoughts just inside your own mind. Self-Reflection (SR) is the other strategy that is used in this experiment. It is associated with introspection and is a form of self-observation. SR is a way of increasing awareness and consciousness. It is a deliberate process relying on thinking and reasoning about thoughts, feelings and actions and their consequences for oneself.

During the literature review no previous studies addressing the effects of positive ST and SR on RT were found. RT can shortly be described as the time that elapses between when a stimulus appears to when a motor response is generated.

The reason for this study about the effects of positive ST, SR and other research in applied sport psychology is well said in the words of J.M Williams and W.E Straub:

“Identifying and understanding psychological theories and techniques that can be applied to sport and exercise to enhance the performance and personal growth of athletes”.

(Cashmore 2008 p.39)

James Driskell et al (1994, p. 481) analyze if different strategies of mental training like applied sport psychology has an impact on performance. His result from a review indicates that the effect on performance is significant and positive. But at the same time mental practice and the strategies that are investigated is defined very loosely. He also mentions a weakness in that many results from research are inconclusive. Regarding the present study on the effect of positive ST or SR on RT this is to be seen as an investigation about two specific forms of sport psychology strategies. The results should therefore be regarded as an example of the benefits or disadvantages for these particular strategies, and not as generalizations of the effect of sport psychology in general.

In a study by Durand-Bush and Salmela (2002, p.161) they examined factors in elite athletes that contributed to the development and maintenance of high and successful performance. Interviews with ten athletes that were gold medalists at two separate World or Olympic championships were conducted. ST was one of the strategies that these athletes used during high level competitions. These athletes also analyzed their performances and engaged in mental preparation in order to develop their skills. One weakness in this kind of studies and similar research is that strategies of ST and SR have been identified as important strategies for successful athletes in competition; but at the same time there are no studies that show if less successful athletes also use the same strategies and still fail. Gould and Maynard (2009, p.1396) conclude that more studies are needed to address this subject. It is therefore also interesting to notice if strategies with ST and SR can generate improved performance compared to a control group.

2. Background

To understand if psychological strategies can enhance performance; performance has to be measured. In most sports athletes need to make quick judgments about their surroundings. They react to, and choose from (or ignore) thousands of stimuli during practice and competition. And this ability connected to sport psychology has been measured in a very limited amount of research and has not before been connected to strategies of positive ST or SR. In this study the positive ST is positive statements generated by the athletes themselves regarding their own training. The other intervention is SR when athletes evaluate their own performance and the consequences of their own behavior. They get directions to write down alternative strategies to use in the future to improve performance.

2.1 Self-talk

In a twenty-five year overview of the articles in Journal of Sport Sciences (Williams et al, 2008 p.406) ST is identified as one of the discipline that has been given the most attention from researchers during the last years. Today we are aware of the use of ST in athletes but at the same time this article concludes that there has been relatively little research done into the effects of using ST to enhance athletic performance.

In a review article Hardy (2006) give a thorough analyze of the ST literature. ST can be seen as verbal statements addressed to one self. ST serve at least two functions, it can be instructional and/or motivational. In the nature of ST the interpretations of the statements addressed to oneself is always present. Two similar ST don't have to be interpreted the same by two different persons. Hardy also concludes that ST is multidimensional in nature.

Hardy chooses to describe six different aspects connected to ST:

- ST can be positive or negative.
- ST can be overt (other people can hear it) or covert.
- ST can be assigned or freely chosen, a perspective regarding on how self-determined the statements are.
- ST is connected to motivation; individuals can view their ST as de-motivation or motivation.

- ST can have different functions for an athlete, this is connected to why an athlete employ ST
- ST has a frequency dimension, targeting how often ST is employed

ST is a complex area, and in search of a short and useful definition of ST this statement is found in *Foundations of Sport and Exercise Psychology* (Weinberg and Gould 2011 p.228). ST is "...the communication we have with ourselves." In this study one of the intervention methods focus on positive ST. The ST is freely chosen and generated by the athletes themselves. One assumption doing this is that to be able to write down personal positive ST statements the athlete needs to be able to generate positive thoughts.

2.2 Self-reflection

Self Reflection has been the subject of attention in many different fields of research. In medicine self-reflection is recognized as an important tool. Learning logs has been used as a method to emphasize this learning process (Neimi 1997). In management SR has been used as a tool for self-appraisal to help employees to perform better at work (Campbell and Lee 1988). To help future teachers to reflect this subject has received attention from teaching and teacher education (Jay and Johnsson 2002).

One definition of reflection came from philosopher John Dewey. In 1933 he wrote about reflection as: "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it ends". (Jay and Johnsson 2002 p.74) Focusing on the word "active" SR come from the person itself and this connects SR to the area of autonomy. Autonomy can be described as having a clear sense of yourself, and also a belief that it is possible to act independently of others (Weinberg and Gould 2011 p 570). One assumption is that it can be hard to SR if you have a low autonomy and constantly rely on the judgments of others.

Knowles and Gilbourne (2010 p.506) write down three criteria that is connected to SR in sport:

- SR that is technical and linked to efficiency and effectiveness
- SR that is practical and linked to the exploration of personal meaning
- SR that is critical

In this study no differentiation between the different forms of SR is done, the SR assigned in the diaries have a broad and open definition to help the participants to understand the assignment. Inspiration for a short definition of SR that is suitable can be found in the research surrounding SR in teaching. It has been somewhat modified here to no longer be connected to teacher education "...look back on events, make judgments about them, and alter behaviors in light of new knowledge." (Jay and Johnsson 2002 p.75)

2.3 Reaction time

One definition of reaction time (RT) is: "The minimum time that elapses between the moment an unexpected stimulus is presented and the beginning of a motor response..." (Cashmore, 2008, p.357) Simple reaction time is the time between a single stimulus and a single response. Choice reaction time is more complex and consists of two or more stimulus and also has two or more different responses. (Cashmore 2008, p.357) For example 4choice RT consists of 4 different stimuli each connected to an individual response.

Some basics of understanding RT in human was published during the 1950^s. In 1952 Hick published an article named *On the Rate of Gain Information* (Hick, 1952) this showed that if there are more choices to consider more time is also needed react. The RT increases as a function of the number of responses. This is to be known as Hick's law.

Two years later Fitts published an article named *The information capacity of the human motor system in controlling the amplitude of movement* (Fitts, 1954) saying if RT does not increase when more choices are available this will lead to that accuracy is sacrificed and resort in more mistakes.

One more general law interconnected to RT is the *Power law of practice* (Newell and Rosenbloom 1980 p. 51). This law is based on the fact that almost always performance improves with practice. More practice results in more improvements. This should always be considered during experimental designs. This is why the use of a control group is essential to determine that the changes in RT is due to the intervention and not based on practice.

2.4 Diaries

A method to use diaries to address SR is described in *A three-step method of self-reflecting using reflective journal writing* (Riley-Doucet and Wilson, 1997 p.964, 967). Nurse students used reflective writing and reported that they could recognize their strengths and their own growth process. Teachers reported that the students became more focused on their own learning process. Letting students direct their own learning process and come to their own conclusions regarding what they need and want to learn were connected to self-responsibility and autonomy. Self-responsibility and autonomy has also been defined as important traits in elite sport. (Ericsson et al 2007).

3. Previous research

ST has been investigated in a number of studies; some of the results show:

- Athletes use ST at sport related arenas like in the practice environment or in the dressing room. The second most common place for athletes to use ST was at home.
- The three most common times athlete's use ST was prior and during competition and during training sessions.
- Positive ST in athletes was reported to be much more frequent compared to negative ST. Most common was that athletes used short phrases when talking to themselves (for example: "come on"). Second next common was cue words but they were not as common as phrases. ST was also used for instructions.
- Athletes used ST for cognitive or motivational reasons. Motivational reasons were more common and a majority of ST was used as for example to focus, psyching up, enhance self confidence, relaxation and drive. Cognitive reasons to use ST were for example skill development, performance improvement and strategy.

(Hardy 2006; Hardy et al 2004; Hardy et al 2001)

Research show that more skilled athletes use more planned ST than less skilled athletes (Hardy et al 2004 p. 254). If athletes gain an advantage by using ST and if it in turn is connected to better performance has also been investigated. The majority of this research focuses on positive ST. The general conclusion is that positive ST relates to better

performance (for example in tennis, (Mamassis and Doganis, 2004) figure skating, (Ming and Martin, 1996) dart-throwing (Cumming et al, 2006) endurance performance (Hamilton et al 2007), cross country skiing (Rushall et al, 1988) and water-polo (Hatzigeorgiadis et al 2007)). To summarize a large number of articles independent of research strategies promote that positive ST is associated to better performance.

In an observational study of junior tennis players during matches negative ST was twice as common as positive ST (Van Raalte et al 1994). The explanation for these conflicting results is probably that the results from the tennis study were based on observation of players and other studies used a survey or interview to ask athletes about their use of ST. This could be interpreted like negative ST is the most common ST that can be seen in observations but that does not mean that it is more common than positive ST, just what it is easier to observe.

Negative self-talk has been associated to poorer performance (Gould et al 1992). In observations more negative ST was associated to losing (Van Raalte et al 1994). A relationship has also been found between negative ST and goal-performance discrepancies (Hatzigeorgiadis and Biddle 2008). Worth mentioning is that negative ST under some circumstances has been related to better performance, even if the improvements has been less than those generated by positive ST. In endurance performance Hamilton show that performance also improved after an intervention with negative ST (Hamilton et al 2007). Peter and Williams (2006) show that one possible explanation for this is the cultural background of the athletes. They show that East Asian athletes are more drawn to use negative ST and that it for them leads to improved performances. In Europe and America positive ST is more common and also lead to improved performance. It could be important to recognize that interventions with positive ST could have different effect dependent on the cultural background of athletes.

The intervention in this study is based on positive ST. The effects of positive thinking have been investigated in many areas. In *Positive Psychology An Introduction* (Seligman and Csikszentmihalyi 2000) some of the effects related to positive thinking and health benefits are presented. At the same time this research has generated some criticism for being inconsistent (Pressman and Cohen 2005). A review from 2011 (McCarthy 2011) addresses positive thinking and sport. Being positive and optimistic is seen as a winning trait. It influences

specific components of performance in athletes like psychological wellbeing and attention. A conclusion is that the benefits of positive thinking in sport probably haven't been truly realized. But it also sends a warning that the depth of this research is too thin to make really bold statements of the value of positive thinking in sport.

The other intervention is based on SR. Barry J Zimmerman has published a series of articles related to self-reflection. In *Self-regulation and motivation: Historical Background, Methodological Developments, and Future Prospects* he uses the term *self-regulated learning* (SRL) (Zimmerman 2008). He describes how measuring SKL can generate significant predictions of the academic results of students. Strategies that students use are similar to the ones found in sport psychology; setting goals, selecting and using strategies, and self-monitoring one's own effectiveness. The core of SRL according to Zimmerman is that the learner demonstrates personal initiative, perseverance and adaptive skills. In another article Zimmerman concludes that self-regulation of learning is not to be seen as a trait that either is possessed or lacked (Zimmerman 2002 p. 66). In this study the use of SR is simplified compared to SKL but many of the ground principles regarding the use and the potential benefits is the same. It is also interesting to notice that the use of SR is a skill that can be developed.

Connected to SKL is Eriksson's work on deliberate practice. He shows that experts spend a lot of time everyday training by themselves and find these activities meaningful. They vary, investigate and change their methods in order to discover new ways to reach self-improvement. (A summarizing of Eriksson's work can be found in the article *The making of an expert* (Eriksson et al 2007).) Expert athletes have also been shown to outscore non experts and novices in terms of self-regulation (Kitsantas and Zimmerman 2002). Another article addresses if there is a difference between the talented and "best of the best" of the most talented young athletes (age 12-16 years). This study shows that "reflection" was the trait that distinguished athletes at a high level from the "best of the best" athletes. One suggestion is that reflection can help talented young athletes to acquire the characteristics necessary during their "talent" years to be able to reach the highest level of competition as adults (Jonker et al 2010).

3.1 Reaction time in previous research

In this experiment RT is measured before and after an intervention with ST or SR. It is therefore important to address why RT is interesting in connection to sport performance. In a meta analyze Mann (2007) show that more successful athletes (experts) have a shorter RT compared to less successful athletes (non experts). Another example is Kokubu et al (2006) that show that volleyball players have shorter RT compared to non athletes. If athletes can use this ability to faster understand and interpret stimuli one hypothesis is that they will be more successful.

Previous research regarding the effect of sport psychology interventions and RT has resulted in mixed results. One example is a review by Grouios (1992) that summarize that it leads to improvements. But contradictory results that show no improvements can also be found (Boschker et al 2002; Shanks and Cameron 2000). It seems like imagery has been the most evaluated intervention. No results between ST and SR connected to changes in RT have been found.

A large number of variables can affect RT. Research has shown that RT is affected by gender, age, training status, stress, sleep, muscle tension and right-and left-handedness. (Délingers et al 2004; Kashihara and Nakahara 2005; Koen et al 2005, Araki and Coshi 2006; Dane and Erzurumluoglu 2003; Adam et al 1999; Hultsch 2002).

It is important to notice that there also is support in the literature that cognitive functions can affect RT. Panayiotou and Vrana (2004) show that self focus and a nervousness to be evaluated result in shorter reaction time (sic!) More in general research show that what you think about (or not think about) before and under performance influence the results (Singer 2000). In one study tennis players was assigned to listen to music during a choice RT test. This experiment showed that higher music generated faster response times (Bishop et al 2009).

4. Aim and Questions

The aim of this study is to evaluate if positive Self-talk (ST) or Self-Reflection (SR) can affect reaction time (RT) in young athletes.

Questions:

- Does reaction time change after one week intervention with positive self-talk or self reflection?
- Is there a difference in reaction time changes between groups when the positive ST group and the self-reflection group are compared to a control group?
- How did the athletes experience the intervention?

4.1 Theoretical frame work

In this study the hypothesis is that intervention with ST or SR could affect RT. Some explanations for potential changes in RT due to interventions of positive ST and SR can be found in theories surrounding motivation, information processing and focus of attention.

4.1.1 Self determination theory (SDT)

In this study the use of SR could influence ones sense of being competence by taking a greater responsibility to analyze one owns trainings. SR is also closely connected to autonomy and the ability to make own judgment and influence the outcome of events. Positive ST has been connected to successful athletes so this could also be a way to enhance the feeling of being competence and experience wellbeing and a feeling good in the milieu surrounding sport and competition.

Self determination theory present a model there motivation is influenced by three needs and how well they are fulfilled. It is hypotheses that enhancement in motivation could generate an improvement in performance. It shortly this theory proposes that three needs is crucial to achieve a high level of motivation. These needs are:

- Relatedness: to feel connected to other people
- Competence: to be able to function effectively

- **Autonomy:** to feel a sense of initiative coming from oneself and an ability to control aspects of life.

(Weinberg and Gould 2011, p 423.)

In an article targeting goal pursuits in relationship to self-determination theory (Deci and Ryan 2000 p 227) conclude that a critical issue is to what degree people are able to satisfy these basic needs during the time they pursue and attain their goals. If individuals are in a social context that satisfy these needs this leads to a natural growth process and better performance. On the other hand those that forestall these needs so the athletes don't feel autonomy, competence or relatedness this is usually associated with poorer performance.

An increase in motivation to perform a task could therefore be one possible explanation if an improvement in RT is present.

4.1.2 Information processing

The human brain has in this theory the form of a processor of information much like a computer. Information processing is the receiving, interpretation, organization and responding to every form of information the human brain is capable to take in. The brain can store thousands of bits of information regarding just one action. For example information from previously similar situations can be retrieved from memory and help an athlete to make a different but more accurate decision based on experience. Information processing is going on constantly, it has been connected to anxiety and arousal in sport. At a certain level of arousal the information processing capacity is optimal (Cashmore 2009 p. 229). With the use of ST and SR it is possible to set rules for how to react in certain situations that can generate a correct response faster than by trial and error (Hardy, 2006). It is also possible that using ST and SR can result in an ability to adjust the arousal level to a level that stimulates optimal information processing. The ability to increase arousal by *psyching-up* is described in sport psychology research. For example the connection between psyching up and muscular force production (Tod et al 2003).

4.1.3 Concept of attention

In studies surrounding ST it has been proposed that the effect on performance can be explained by that ST can direct attention focus (Landin et al 1999). In *Foundations of Sport and Exercise psychology* Weinberg and Gould (2011 p 364) describe what they believe is a

useful definition of concentration that also revolves around the concept of attention, it consists of four parts.

- Selective attention: being able to focus on the relevant cues
- Maintaining attention focus over time
- Having awareness of performance errors and the situation
- Being able to shift focus of attention if it is necessary

Hardy (2006 p. 90) write that it is possible that the use of ST can assist in accurate switching of attention focus and also to find and maintain the most appropriate focus. But he continues to analyze that it is unlikely that the impact of ST can be explained solely by its ability to affect attention. Connected to RT a tremendous amount of stimuli surrounding a sport setting are present and the competitor has to distinguish between what stimuli's to focus attention on to generate the best results and in this study how to focus to generate a fast response in RT.

Together these theories could provide some groundwork for why ST or SR could affect RT. In previous research it has been more common to perform in subjects design studies or address if ST or SR is present during competitions or trainings. This mean no previous explanations connecting these two areas have been found in the literature.

Therefore three theories have been selected to give some suggestions about how an interaction could be constructed. To try to explain these connections is a very complex area and the explanations provided are oversimplified and cannot strive to give all the answer.

5. Experiment design

This study is a randomized laboratory experiment. An intervention of positive ST or SR was conducted with the use of training diaries for one week on a population of 16 year old athletes. The purpose was to investigate if this intervention could affect reaction time. After the experiment an inquiry was handed out to the participants to address their thoughts about using the diary and if they believed it could affect their performance.

It is a between subjects design and therefore differences will only be seen on a group level. The participants N=29 were randomized in to two experiment groups (EGs) and one control group (CG). To evaluate the effects of the intervention pre-tests of RT was conducted before

the intervention and a post test was conducted within 24 hours after the completion of the intervention.

5.1 Participants

29 athletes at the age of 16 years took part in the experiment. The participants consisted of students at a high-school program specialized towards sport and exercise. The class consists of 16 males and 13 females (N=29) with a median training experience in their current sport of 8 years. All the participants had a training background that involved more than one sport while growing up. In general they trained 5 times during an average week. Sports that are represented by the students were soccer, ice hockey, badminton, athletics, sailing, tennis, climbing, dance, strength training, spinning, MMA, riding, swimming, and basketball. Soccer was the most common sport (N=8), followed by athletics (N=3).

5.1.2 Selection

The students were recruited by asking their PE teacher if a class of students within a class specialized on sport could take part in a sport psychology intervention during their school schedule. The selection of participants in this study was made by convenience. One PE teacher was asked if she knew any sport specialized classes and she selected the class that is used in this experiment. The main purpose of choosing school students was that a large number of participants were necessary to perform an experimental design with two EG and one CG. The other aspect is timing. It was important to establish that the re-test were at the same time after the intervention in all three groups. This is easier to perform in a school setting where the students follow a set schedule and the tests could be done during fixed classes.

4.1.3 Information to participation

The participants were given spoken information about the experiment at a short presentation in class and were asked if they wanted to participate. They agreed to participate. After the first pre-test of RT a new meeting was set during the use of the training diaries was further introduced. Information was given to the participants surrounding the diaries and the importance to read the instructions carefully and write down in their calendars a reminder to bring the diaries back to school after one week so they could be collected.

At the title page in the diaries was a reminder that the experiment is voluntary and that it's possible to terminate participation at any stage. This is according to research ethics and the

participants own choice to take part in the experiment. To use students at a school setting is described in *Idrottsvetenskapliga Foskningsmetoder* (Hassmén and Hassmén; 2008 p. 205) they address the importance of respecting the participators, have a close cooperation with teachers and ask the guardians permission to let the students take part in the experiment if they are under 16 years of age.

5.1.4 Randomization

Before the pre-test started a randomization was made by lottery to divide the participants (n=29) in two experimental groups (EG) and one control group (CG).

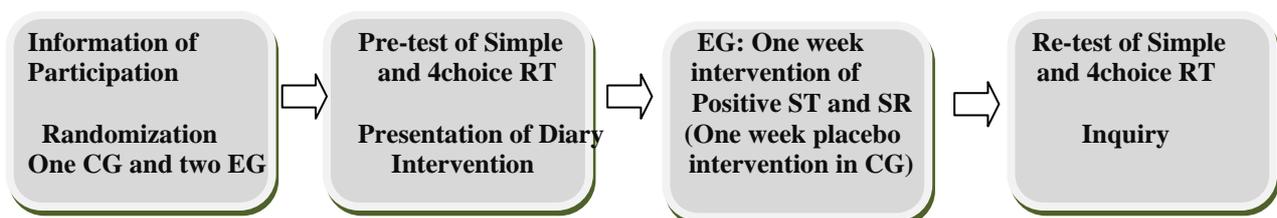


Fig. 1 Time course of the experiment (CG: control group / EG: experiment group)

5.2 Test methodology

The same person that wrote this paper was also responsible for the data collection during the pre-tests and post-tests. The pre-tests and post tests were carried out at location of the school where the participants had classes. The pre-tests was split and conducted during 4 different days during one week from Tuesday to Monday. At one time the pre tests were conducted during a PE class. The participants during this test were inactive during PE class before the testing to establish that the same conditions would be present regarding all the tests. To test one individual had an estimated time span of five to ten minutes.

During all the test written instructions of the test procedure was given to the participants before testing (appendix 5). Verbal instructions given by the test leader were also predetermined (appendix 6). Both the verbal and written instructions were tested in a pilot study before the experiment. As far as possible all the information given was predetermined to follow the same pattern for all the participants.

The training diaries for EG 1 and the CG was handed out on a Tuesday and post testing were conducted during the following Tuesday. The diaries for EG 2 was handed out on a Friday and post tests conducted on this group were the following Friday. The post-tests of RT were conducted during a period of 24 h after the one week intervention.

The order of the RT tests during the pre-tests and post-tests were

1. Simple RT
2. 4Choice RT

5.2.1 RT Tests

The test battery is a student version of a research software program designed to test Simple and 4choice reaction time (FingerReactionExperimentToolbox). The tests can be performed on a regular computer using the keyboard. The reaction is measured from the time stimuli in the form of a letter appear on the screen to the time the correct letter is pressed on the keyboard.

For simple RT the letter H will be visual in a circle on the computer screen, when the circle turns black the participator is supposed to press the letter H on the keyboard as fast as possible. This test consists of ten trials and has an estimated time span of 40 seconds.

The other test; 4choice RT consists of four letters; D, F, H and J. They will all be visual on the desktop and the assignment is to press the matching key on the keyboard when a circle containing a letter turns black. This test consists of 40 trials and has an estimated time span of 3 minutes. The 4choice RT test was not randomized; this mean that the same order of letter will appear every time the test in conducted. Due to the number of stimuli (40) and that it is one week between tests it is assumed that it would not be possible to memorize the combination of letters, especially regarding the fact that the participators were not aware of that the same test would be used twice.

5.2.1 Inquiry

After the post-test an inquiry was handed out to the participants regarding their training background. They were also asked if they believed that the diary intervention could affect their performance and how they experienced writing in the diary in general (appendix 7). The inquiry was constructed of mainly closed questions. Basic facts like what sports the participators were active in; their number of training sessions a normal week, and how long they had trained their current sport were also addressed.

To know if the participants were positive about writing in the diary or not could be useful information if a diary should be incorporated in a club or a team. It is also interesting to notice if they believed this intervention could affect performance. It is possible that the participants could like writing in the diary and at the same time do not believe it could have any effect.

5.3 Intervention Methodology; Diaries

Before the diaries were printed a pilot test where all three diaries were tested on active athletes for one week were conducted. After this some changes were done to make it easier to understand the instructions. Three different diaries are used in the study (appendix 2, 3 and 4). The aim was to make them as similar as possible. As far as possible the same words are used with small changes in the instructions. If more than one day of writing in the diary was absent or not connected to the assignment this participants RT registration was not used and he/she was removed from the data analyze. A total of five diaries and corresponding RT registrations were removed from further analyze due to incomplete diary writing.

The diaries start with clear instructions of what the participants are required to write down and how this should be done. Instructions on how to act if you forgot to write down your assignment during one day are also available, followed by contact information in case of questions. The choice to use trainings diaries as an intervention was made by the assumption that many athletes use a training diary to monitor their training and are used to this concept. The use of a diary would therefore be easy to incorporate in a group of athletes.

The diaries were constructed as follow:

- First page contains instruktions
- Second page is an example of how to correctly write a diary page.
- Page 3-10 consists of one page with questions to answer each day for one week.

Hardy (2004) conducted an intervention with diaries for three weeks were participants wrote down their negative ST. But the participants in Hardy's study only wrote in their diaries three times a week after training. The difference between Hardy (2004) and the present study is that the participants are required to write in the diary every day during one week.

Inspiration for the construction of the diary was found in *Using Diaries for Social Research* (Andy Alaszewski 2006). The diaries will in one sense be used as a control mechanism to confirm that the participants have been writing down their assignments. At the same time the diary is the intervention used to encourage and help athletes develop their positive ST or SR. Writing down TV programs worked as a placebo in the CG to minimize the potential effects of writing down an assignment could have on RT.

After the closure of the intervention the diaries were collected and analyzed. All diaries were estimated regarding the notations from the participants. Notes from each day were analyzed regarding if the assignment to fill in positive ST or SR were correct. If the writing were inconclusive or if more than one day of writing were absent the RT registrations connected to that diary were removed from further analyzes. A total of 5 diaries and connected RT registrations were removed from further analyze due to incomplete or absent diary writing.

5.4 Apparatus and Test Set up

During the pre and post tests a separate room with a closed door were used there one table, two chairs and the computer with the RT testing programs were located. The test leader was present in the room during the tests. The participants could not see each other when performing the tests. Due to different days and location of the tests different rooms was used but the same set up of table and chairs were present. The rooms were not equal in size but all had privacy and a closed door to keep the participants from being distracted during the tests.

The tests was conducted on a laptop; HP Pavilion Entertainment PC. All the testing was conducted on the same computer. The participants were sitting on a chair looking at the screen from approximately 30-40 cm distance.

5.5 Statistical Analysis

Looking at the groups separately a non parametric Wilcoxon's matched-pairs signed ranked test was used to determine differences between the pre-tests and post tests. To detect differences between groups a non parametric test; Man Whitney U test was used. A non parametric test was chosen because it is more conservative and does not demand an assumption of a normally distributed data. A paired T-test was used as a robustness check. The results are reported as mean value \pm standard deviation (SD). The significance level was set at $p \leq 0.05$.

5.6 Validity

To assess validity is more complicated when the research is exploratory and no previous studies were found regarding the same subject. This means that no earlier validated studies regarding this subject can be used for comparison. The external validity in this case lies in that other studies can use the experimental design described in this study to replicate the same procedure on a different population.

In this study a randomized experimental laboratory design was used. It is a between subjects design. This leads to that changes due to the interventions only can be seen at group level and not at an individual level. The use of an experimental design with a control group (and placebo) is seen as the strongest design for testing causality. Using a randomization of the participants also speaks for a strong research design to get equivalence between groups (William and Wragg, 2004 p.37).

It is hard to estimate how much use of ST or SR the participants used by themselves before the experiment. With a group design and randomization the individual prior use of mental strategies should be distributed evenly between EGs and CG. And the effects can be seen as a way to investigate if this form of mental training has benefits to be implemented in a group of athletes or a team. With randomization the study also addresses other differences between the participants. For example gender, age, left–right handedness have been established factors that affect reaction time. With a randomization these differences should be equally distributed between groups. One weakness is that 30 participants could be too few to address predetermined differences by randomization.

The inquiry was handed out to the participants after the post-test of RT (N=29). The test-leader was present in the room. There were no drop outs in the inquiry and all participants' answers were analyzed (appendix 7). The background questions regarding prior training history and number of training sessions a normal week were open questions not to limit the participants' answers. The questions about how the diary intervention was experienced and if they believed it could affect performance were closed questions to avoid interpretations of the results.

5.6.1 Internal validity

To address the internal validity pilot studies were conducted both regarding the intervention with diaries and the spoken and written instructions during the RT tests. Six diaries were distributed and six martial art athletes used the different diaries for one week. The three different kinds of diaries were made to resemble each other as much as possible. The color is the same and the instructions use the same phrases with some exceptions to explain the different in instructions. All the diaries were connected to an identification number so they are not connected to any participant by name. The only aspect when the diary would be connected to a special person would be if the diary after analyze haven't been used as required. Information was given to the participants to work individually and not discuss or show their diaries. The optimal way to avoid any spill over affects would have been to let one group perform the experiment before the second one and third one. Due to time aspects this was not possible. The diaries were handed out on two different days a Tuesday and a Friday with the post –test conducted on the following Tuesday or Friday.

The written and spoken instructions during the RT test were tested in a pilot study. During RT tests the written and spoken instructions worked very well (can be seen in appendix 2 and 3). Few exceptions in form of answering questions from the participants were present. This was done to avoid any unnecessary intervention from the test leader that could influence the participants and their results. The RT tests were conducted on the same computer. It was brought to the school were the students had classes. One separate room was booked for the RT testing. The rooms were different in size and furniture. The same set up of a computer and two chairs were used in all test conditions. All rooms had a closed door avoid distractions; the test leader was present in the room but stepped away during the testing not to stress the participant. During one test the participants were active in PE class, if they were conducting the test during this class they were instructed not to take part in physical activity before testing to establish the same conditions for all participants.

5.7 Reliability

The test battery is a student version of a more complex software program design to measure reaction time (FingerReactionExperimentToolbox). The Simple RT test was composed of 10 observations, and the choice RT test was constructed of 40 observations. The accuracy of the reported measurements is registration of RT down to 1 ms (0.001 seconds). All testing was conducted on the same computer a HP Pavilion Entertainment PC.

Some insecurity regarding if the update of the screen image could delay the stimuli to appear on the screen was present. This was addressed by filming the computer screen during tests with a high speed camera. This showed that the time elapsed for the stimuli to appear on the screen were less than 3 ms and this could have a very limited affect on the measurement accuracy.

6. Results

6.1 Falling out

A total of 29 young athletes conducted the tests. Due to technical problems two individuals RT results were not saved during all the tests and the data from these two individuals was removed from the analyze.

After the post test 6 diaries could not be collected for analyze due to logistical problems. (The students didn't bring them to school.) The participants that didn't bring their diaries confirmed verbally that they had fulfilled their assignment. The assumption made in this study was that this was true and the students that had used their diary even if this was not possible to control. The RT results from these participants are therefore still part of the analyzed data. The consequences for including these diaries would not strengthen the results because it cannot be determined that these participators truly fulfilled their assignment. The assumption is that if this would have an impact on results it would make the connection weaker.

All the diaries that were collected (N=23) they were analyzed regarding if their content matched the assignment for the specific group. This was done regarding if the writing were inconclusive, not connected to the subject or absent. Each diary was analyzed twice by looking separately at the content of each day. After viewing the content in the diaries a total of 5 diaries (of N=23 that could be analyzed) had more than one day of writhing missing or the writing was not connected to the assignment (thee in the positive ST group, and two in the SR group). When testing for comparison between groups these observations were dropped.

In the choice RT test the instructions were to react as fast as possible and still press the correct button corresponding to the stimuli. The program didn't record the RT if the wrong button were pressed. The wrong button was pressed a number of times in all three groups. Looking

within groups summarizing all time the wrong button was pressed during pre-tests and post-tests of 4Choice RT the different groups performed as followed: EG1 pressed the wrong button 54 times of all trial and that represented 8 % of the total number of tires. EG 2 pressed the wrong button 5 % of the trials (34 times) and the CG pressed the wrong button 6 % of the trials (39 times.) In analyzing the data only the times when the correct button was pressed is a part of the data analyze.

As a first step a mean value was constructed by collapsing the ten observations of each participants recordings of simple RT in too one mean value for the pre-test and one mean value for the post-test. The same procedure was done with the 40 observations for each test of choice RT per person that were collapsed in to one mean value for the pre-test and one mean value for the post-test. This results in 4 observations for every participant.

6.2 Basic statistics

The total mean values of all participators combined, before and after intervention can be seen in table 2. What should be noticed is that small improvements in RT between pre-test and post test were present in both Simple RT and choice RT.

Table 2: total mean values for all groups combined presented in ms. The reason 24 persons are present is that one person had a useful recording of choice RT during the pre-test and post-test but not for simple RT due to technical problems. This person is included in the basic statistics but dropped during further analyzes.

	Mean value:	Standard derivation:	n:
Simple RT pre-test	312.49	38.66	23
Simple RT post-test	298.20	26.98	23
Choice RT pre-test	452.79	38.43	24*
Choice RT post-test	438.37	35.94	23

Divided by group the EG 1 showed the following results:

Experimental group 1 (EG1): Positive ST

5 male 2 female (N=7)

In EG 1 a small improvement in RT is present in both simple RT and choice RT when comparing the pre-test results to the post-test.

Table 3: total mean values for EG 1 presented in ms.

	Mean value:	Standard derivation:	n:
Simple RT pre-test	317.35	52.20	7
Simple RT post-test	309.36	32.49	7
Choice RT pre-test	457.00	31.97	7
Choice RT post-test	450.49	35.24	7

The group that worked with self-reflection showed the following results:

Experimental group 2 (EG2): SR

3 male 4 female a total of n=7

Table 4: total mean values for SR group presented in ms.

	Mean value:	Standard derivation:	n:
Simple RT pre-test	331.11	36.85	7
Simple RT post-test	302.88	23.48	7
Choice RT pre-test	457.54	43.93	7
Choice RT post-test	423.21	43.08	7

In this group comparing the pre-test to the post-tests of RT in both simple and choice RT showed a much larger improvement than in EG 1.

Control group (CG): TV

4 male 5 female a total of n= 9

The control group that had written down their habits of watching TV combined with their training reported:

Table 5: total mean values for CG group presented in ms.

	Mean value:	Standard derivation:	n:
Simple RT pre-test	294.23	18.69	9
Simple RT post-test	285.89	22.31	9
Choice RT pre-test	447.82	41.75	9
Choice RT post-test	440.72	29.89	9

In this group that a small improvement similar to the improvement in EG 1 was found between pre-test and post-tests in RT.

Looking at the basic data from each group the pre-test results of RT is similar in all three groups. The pre-test of both simple RT and choice RT show that the CG had a shorter RT then the experiment started compared to EG1 and EG2. This could possibly have an effect of differences in RT between groups and this will be addressed further under these results.

6.3 Reaction time changes

Does reaction time change after one week intervention with positive self-talk or self reflection?

Two new variables were created that show the mean difference between pre-test and post-test in simple RT and choice RT within groups.

Table 6: Differences in RT between pre-tests and post test in ms, divided by groups.

	Mean differences in RT between pre-test and post-test in Simple RT	Standard derivation	Mean differences in RT between pre-test and post-test in Choice RT	Standard derivation	n
Control G (CG)	-8.36	15.26	-7.10	25.75	9
Positive ST(EG1)	-7.98	37.53	-6.51	27.93	7
Reflection (EG2)	-28.22	33.43	-34.33	15.44	7

Looking at the results all three groups reacted faster during the post-test compared to the pre-test in both simple and choice RT. The largest difference between pre and post tests were found in the reflection group with an improvement in simple RT with -28.22 ± 33.43 ms and an improvement in choice RT -34.33 ± 15.44 ms. The differences in the positive ST group were small: differences between pre and post tests in simple RT in the positive group were -7.98 ± 37.53 ms, and -6.51 ± 27.93 ms for the choice RT.

The control group also had a small improvement in RT between pre and post tests in simple RT -8.36 ± 15.26 ms and choice RT -7.10 ± 25.75 ms.

Looking at all groups separately EG2 (SR) was the only group that provided a statistically significant decrease in RT time compared to the pre-test in both simple RT ($p=0.028$) and choice ($p=0.018$). No statistical significant differences was found in EG 1 regarding simple RT ($p= 0.866$) or choice RT ($p =1.00$). The results was the same in the CG that showed no significant changes in RT between pre-tests and post-tests regarding simple RT ($p= 0.173$) or choice RT ($p=0.374$).

6.3 Differences between groups

Is there a difference in reaction time changes between groups when the positive ST group and the self-reflection group are compared to a control group?

Using a non paramedic test, Man Whitney U no statistical significant difference in improved RT was found between the control group (CG) and the positive ST group in simple RT ($p=0.711$) or in choice RT ($p= 0.711$).

A statistical significant difference in improved RT was found between the control group (CG) and the self reflection group (EG2) in choice RT ($p=0.003$) where the SR group (EG 2) had a statistical significant improvement in RT compared to the CG¹. Comparing simple RT no statistical significant differences between EG2 and CG were found ($p= 0.125$).

-
1. The difference between pre-test and post-tests are presented in absolute numbers. Regarding that the CG had a choice RT in the pre-test of 447.82 ± 41.75 ms compared to the SR group that had 457.54 ± 43.93 it would be possible that the significant difference in improvement between groups were based on that the SR group performed a slower RT during the pre-tests and therefore would have an easier task to reach improvement in absolute number compared to the CG. This was addressed by creating a new variable constructed by the difference between pre-test and post-tests in relative difference (%). This showed that the improvement in the SR was still significant ($p=0.05$) compared to the CG in relative numbers., and that the results are not based on differences in output values.

6.4 Athletes experience of the diary intervention

In general the athletes were somewhat skeptic about using diaries.

Table 7: How did all groups combined experienced the diary intervention in absolute numbers and %.

	Much giving	Giving	A little giving	Not giving at al
Number of participants (N=29)	1 4 %	11 38 %	14 48 %	3 10 %

A majority of the total number of participants found the diary *giving* (38 %) or *a little giving* (48 %).

Regarding if the participators believed the diary could have an impact on performance the results showed that a majority of the participants do not believe the diary could have an impact on performance.

Table 8: Does participants in all group combined believe the diary could have an effect on performance in absolute numbers and %.

	Very much	Yes, some impact	A little	Not at al
Number of participants (N=29)	1 4 %	9 31 %	11 38 %	8 27 %

In general the participants believed the diary could have some (31 %), a little (38), or no (27 %) impact on performance. One difference to notice is that 10 % of the participators found the diary not giving at all, while 27 % believed it could have no impact on performance. This could be a sign that some of the participators found the diary somewhat giving without believing it could have any impact improving their athletic performance.

6.4.1 Results divided by group

Positive ST (EG 1)

Results from the positive ST group (EG1) showed that out of (N=10) the participants in general found the diary a little giving and that it could have a limited affect on performance.

Table 8: How EG1 experienced the diary intervention in absolute numbers and %.

	Much giving	Giving	A little giving	Not giving at al
Number of participants (N=10)	0 0 %	3 30 %	4 40 %	3 30 %

3 participators found the diary to be meaningful but the same amount 3 persons found the diary not meaningful at al. No one saw writing in the diary as a much meaningful activity.

Regarding if the diary could impact performance only two out of ten participants in EG 1 thought it could have some impact.

Table 9: Does participants in EG1 believe the diary could have an effect on performance in absolute numbers and %.

	Very much	Yes, some impact	A little	Not at al
Number of participants (N=10)	0 0 %	2 20 %	4 40 %	4 40 %

Four participants thought it could have a little impact and the same number thought it could have no impact at all. This group was very skeptical regarding the potential benefits of the diary.

Reflective group (EG 2):

In the reflective group all the participators (N=10) found the diary giving or a little giving.

Table 10: How EG2 experienced the diary intervention in absolute numbers and %.

	Much giving	Giving	A little giving	Not giving at al
Number of participants (N=10)	0 0 %	5 50 %	5 50 %	0 0 %

No one found the diary to be much giving or not giving at al.

In the reflective group half of the participators believed the diary could ha a little impact on performance.

Table 11: Does participants in EG2 believe the diary could have an effect on performance in absolute numbers and %.

	Very much	Yes, some impact	A little	Not at al
Number of participants (N=10)	0 0 %	3 30 %	5 50 %	2 20 %

Three participators believed it could have some impact and two believed the diary would not impact performance at al.

Control group (CG):

In the control group one person found the diary much giving.

Table 12: How CG experienced the diary intervention in absolute numbers and %.

	Much giving	Giving	A little giving	Not giving at al
Number of participants (N=9)	1 11 %	3 33 %	5 56 %	0 0 %

No one found the diary not giving at all, comparing the groups the CG in general were a little bit more positive about using a diary compared to EG 1 and EG 2. Regarding the impact on performance one person in the control group believed the diary could have a great impact on performance and four participators believed that it could have some impact.

Table 13: Does participants in CG believe the diary could have an effect on performance in absolute numbers and %.

	Very much	Yes, some impact	A little	Not at al
Number of participants (N=9)	1 11 %	4 44%	2 22 %	2 22 %

Looking at the answer on the other end of the spectrum two participators believed that the diary could have a little impact and two believed it could have no impact at al. Taken all the answers under consideration a majority of the participators believed the diary could impact performance.

The results in all three groups were similar; in no group the majority of the participants found writing in the diary a much meaningful activity. They in general believed that the diary could have an impact, a small impact, or no impact at all on performance. This assumption was the same disregarding group and what kind of diary they had been using. EG 1 was the most skeptic group and the control group the most positive.

7. Discussion

Does reaction time change after one week intervention with positive self-talk or self reflection?

The results showed that the SR group was the only group with a significant decrease in RT between the pre-test and the post-test regarding both 4choice RT. According to the *Power law of practice* (Newell and Rosenbloom 1980 p. 2) this results are somewhat surprising. The *Power law of practice* is based on that performance in RT improves with practice. Therefore the assumptions would be that all groups would have an improvement in the post-test due to practice effects. The hypothesis would be that this improvement in RT should have been present in all three groups. Regarding the results within groups the positive ST group did have a small improvement in RT (-7.98 ± 37.53 ms in the simple RT; and -6.51 ± 27.93 ms in choice RT) and also in the control group(CG) (-8.36 ± 15.26 ms for simple RT and -7.10 ± 25.75 for choice RT) but this difference between pre and post test was not significant. One explanation for this is probably that the sample size was too small to detect significant differences in RT between pre and post tests. One assumption is that with a larger sample these differences would probably be significant in all groups.

Regarding differences in Simple RT and choice RT some explanations can be found in Hicks article (1952). It describes that if there are more choices to consider more time is also needed to make a decision and react. This also led to a hypothesis that differences in RT should be greater in the choice RT compared to the simple RT. Looking at the results in EG2 were a significant difference between pre-and post-tests were present the improvement in choice RT was larger compared to the improvement in simple RT (differences in simple RT -28.22 ± 33.43 ms, differences in choice RT -34.33 ± 15.44 ms). The reason the results in simple RT is assumed to have a smaller improvement than in choice RT is because simple RT could be a too easy task to perform and further improvements would not be possible due to practice effects or mental training interventions. The risk is that in simple RT the participants are already performing close to their maximum ability. In choice RT that is a more complex task the span for improvement would be greater and easier to detect. But no significant differences was found between pre-test and post-test in the positive ST group or the control group independent of if simple RT or choice RT was tested. Still the differences between pre-and

post-tests in the EG1 and CG is small and again a larger sample size would be needed to confirm if Hicks law is followed or not in this experiment.

Regarding the simple RT results in EG 2 they demonstrated a significant statistical improvement -28.22 ± 33.43 ms. This could in some way speak against earlier research and show that improvements can occur also in simple tasks.

Is there a difference in reaction time changes between groups when the positive ST group and the self-reflection group are compared to a control group?

No statistical significant difference in improved RT was found between the control group (CG) and the positive ST group in simple RT ($p=0.711$) or in choice RT ($p= 0.711$). Positive ST does not seem to be connected to RT regarding this specific intervention. One explanation for this could be that positive ST might be more connected to wellbeing and health benefits (Seligman and Csikszentmihalyi 2000). And that positive thinking works more in general and is not as inflectional on optimizing specific performances as RT. McCarthy (2011) addresses positive thinking in sport and describe that it can influence specific components like attention. The question is what kind of attention? It is possible that the attention used by the athletes are very situation dependent and related to their sports and can be seen in specific sport settings but not in a more controlled laboratory experiment. McCarthy also says that the research of positive psychology is limited today and more studies needs to be conducted before any generalizations can be made. But the results in this study at least indicate that positive ST does not seem to have a direct impact on RT in athletes.

Regarding one of theories that could be used to explain changes in RT, the Self-determination theory (Deci and Ryan 2000) describes the three needs that are necessary for motivation. It is possible that positive thinking does improve wellbeing but not relatedness, the feeling of competence or autonomy that in turn can lead to improved motivation and performance.

It would also be interesting to analyze the form of positive statements made by the individual athletes and see if there is a pattern if some specific forms of positive statements like “psyching up” could lead to improved performance. This was not possible to conduct during this experiment but would be interesting to address in the future. For example “psyching up” has been regarded as a way to enhance for example muscular force production with the help of positive ST (Tod et al 2003).

Analyzing the diaries more closely and connect them to a specific RT would show if the athletes that used positive statements to “psych up” might have a result in RT because “psyching up” affect arousal that in turn can affect the optimal level of information processing (Cashmore 2009 p.229). (Other ways athletes can use positive ST was for example telling oneself that they look good or that they were having fun.) It is possible that letting the athletes choose their own positive ST resulted in big differences in the content of positive ST between the athletes.

A statistical significant difference in improved RT was found between the control group (CG) and the self reflection group (EG 2) in choice RT ($p=0.003$) where the SR group (EG1) had a statistical significant improvement in RT compared to the CG. Comparing simple RT no statistical significant differences between EG 2 and CG were found ($p= 0.125$). Some explanations why self-reflection seems to lead to an improved RT performance can be found in Ericsson’s work about deliberate practice (Ericsson at al 2007). Experts seem to spend a lot of time investigate and change methods to change their own behavior to reach self-improvement. It is possible that learning to evaluate trainings and take responsibility to find ways to improve performance can lead to more serious approach during all kind of performance and that these athletes tried harder and were more motivated and therefore reacted faster. The question is if these strategies could be developed during such a short time period as one week, how long time it takes to develop strategies for deliberate practice would be an interesting subject for future research.

Zimmerman (2002) describes that self-regulation and learning to take responsibility for one’s own performances is not to be seen as at trait someone ether possesses or lack. It is a process that someone can learn and develop thru experience. To take a greater responsibility to think about and analyze performance has also been seen to distinguish novice from experts in sport (Kitsatas and Zimmerman 2002). It might therefore be possible that learning this skill can help athletes outscore athletes with the same background who has not participated in this kind of training strategies.

Further possible explanations for these results based on the theoretical framework could be that it is possible that SR does influence motivation components in self-determination theory (Deci and Ryan 2000) by enhancing the feeling of competence by taking a greater responsibility for personal training and development. Something that is closely related to self-

reflection is the feeling of autonomy. That you have control over and can affect your own situation. By increasing these motivational components the motivation needed to perform could be improved which in turn generate better results. Worth to remember is that motivation is also a complex area and looking at the results from the enquiry the participators were skeptical about the potential benefits of using a diary to improve performance and therefore it could be hard to argue that the diary would in fact enhance motivation.

Regarding the concept of attention it is possible that SR can help the athlete to learn and use self-regulation and be aware of the optimal way to use attention in the present situation to perform as good as possible. In Weinberg and Gould's (2011 p 364) definition of concentration they describe four different parts of attention:

- Selective attention: being able to focus on the relevant cues
- Maintaining attention focus over time
- Having awareness of performance errors and the situation
- Being able to shift focus of attention if it is necessary

It is possible that these strategies can be learn during an active analyze made by the athletes after every training to enhance performance. In general it seems to be hard to find strong evidence for the effect of mental training on RT. Previous studies have resulted in mixed results (Grouios 1992; Boschker et al 2002; Shanks and Cameron 2000). Therefore all results should be regarded with a natural skeptic until the studies have been reproduced with results that support the findings in this experiment.

How did the athletes experience the intervention?

Interesting to notice is that the results in all three groups were similar. Were the general conclusion is that athletes did not believe the diary could have a strong impact on performance. Only one athlete out of (N=29) believed that the diary could have a big affect on performance and this person was a part of the CG writing down trainings and TV programs. The CG was surprisingly the groups that were the most positive about writing in the diary. Before the intervention one assumption was that the participators in the study would find it more meaningful and believe that positive ST or SR could have a greater impact on performance compared to writing down TV programs.

The easiest explanation could be that the young athletes in this study do not believe that these strategies can influence performance in any extensive way. Learning from this in future experiment the diary might have to be constructed in a different way to attract athletes to write every day and find the assignment meaningful. How the athletes experience the diary is important information. If this strategy of using positive ST diaries or SR would be applied in a club or a team the recommendation is to first do some changes to make them more attractive to write in for the athletes. One other reason for these results can be that writing down TV programs does not take the same amount of concentration or personal judgments as writing down positive ST or SR. One explanation for not finding the diary intervention meaningful in EG1 and EG2 could simply be that the participants experienced the assignment hard to perform. With a longer intervention with diaries this process would feel more natural and writing would be easier to perform without much effort. It is also possible that the diaries still are a good strategy but they need to be used during a longer time period.

One possibility is also that the interventions generate different thoughts compared to the aim of positive ST and SR. It is possible that becoming more aware of positive ST also lead to an increased awareness of negative thoughts that could affect performance. More research of the participant's experiences of the interventions is needed. But in general this does not influence the results on RT but it is worth addressing that other thoughts beside positive ST and SR can be influential.

6.1 Practical applications

Much previous research has shown the benefits of positive ST and SR. For example for SR (Eriksson et al 2007; Kitsatas and Zimmerman 2002; Jonker et al 2010) and for positive ST (Mamassis and Doganis 2004; Ming and Martin, Cumming et al, 2006; Hamilton et al 2007; Rushall et al, 1988; Hatzigeorgiadis et al 2007). Even if the results of the effect on RT in this study are not overwhelming, positive ST and SR have shown to be important traits in successful athletes in a number of studies. It would therefore be interesting to investigate if these interventions could affect other aspects of athletic performance such as concentration or motivation.

6.2 Strengths

It is a strong experimental design based on the principles of a true experiment containing a control group. This makes it possible to address the causal effect of positive ST and SR on RT. Many earlier studies in the sport psychology domain are in subjects design that can lead to difficult judgment of with effects is due to effects of attention of researchers compared to interventions. By randomization of the participants differences that could affect RT should be equally distributed between groups.

This study provides an assessment of the use to implicate specific forms of mental training strategies on a group level. This is important knowledge for trainers and sport psychology consultants. It is exploratory research investigation effects of two forms of popular mental training strategies (positive ST and SR) on a general important quality (RT) of successful athletes. In the design great effort is made to keep the internal validity at an acceptable level. The test procedure is reproducible and invite to further research.

In the choice RT test the instructions was to react as fast an as correct as possible, the program did not record the RT time if the participator pressed the wrong button. The wrong button was pressed during the test in all three groups. This means that if the participators did take greater risks and sacrificed accuracy for faster response according to Fitts law (Fitts 1954) this could be a source for error. After analyzing the how many times EG 1, EG 2 and the CG pressed the wrong button this showed that the only group with a statistical significant improvement in RT also was the group that had the highest accuracy. Therefore the results in RT improvement can't be explained in the light of this group sacrificing accuracy for gaining faster responses.

There were some questions concerning that the pre-test results in 4choice RT from the CG were faster compared to the SR group were a significant statistical difference in improved RT were found between groups. (CG 447.82 ± 41.75 ms compared to the SR 457.54 ± 43.93 ms.) Further tests confirmed that the difference between groups were still significant ($p=0.05$) taking in to account the differences of output values between the two groups.

6.3 Weaknesses

After the post test 6 diaries could not be collected for analyze due to logistical problems. (The student's didn't bring them to school.) The participants that didn't bring their diaries confirmed verbally that they had fulfilled their assignment. This should not impact the results by making the connection between the interventions and the results stronger. But the opposite is possible, that these participators RT not are affected in any way due to the intervention (if they did not use their diary) and this could have a negative effect on the results showing a smaller improvement in these groups compared to if every diary could have been controlled.

To measure interventions witch focus on changing thoughts and feelings inside individuals are very difficult. This is a first step with a new method to address affects of positive ST and SR on RT. Some assumptions are made in this experiment. One is that the participators are able to generate positive thoughts in the form of ST and that they can take a distance from themselves to use SR. One weakness is that it is not possible to establish if the positive ST and SR are generated from the participants themselves and not just reproduced feedback from trainers, family and friends.

The participants were informed to work individually and not discuss or show their diaries to other students. Due to time it was not possible to distribute the diaries over separate weeks. One weakness is that it is not possible to determine if the students have influenced each other. This was address by instructions to work individually and by handing out the diaries on two separate days.

The connection between intervention and RT can be perceived as weak. This because the intervention with positive ST or SR was not direct connected to the RT test. The interventions instead regarded the athletes own trainings during the week, and their sport and performance in general during the days that they didn't have any trainings. To generate a more close connection could lead to further questions of validity. If for example the participants in the positive ST group would be assigned to think positive thoughts about the RT test it would not be possible to separate if the results are due to the intervention of positive ST or that they were reminded of the previous test. Therefore a choice was made to make the connection weak and the reason for this is to have as "clean method" as possible to reduce the possibility of spillover effects.

The participants can be affected by the fact that the test leader was the same person as the author of this study. The test leader could involuntarily affect the results in one direction. This is addressed by trying to predetermine as much as the test procedures as possible for example with an identification number and not connecting the participants to a specific group during post tests, and predetermined written and spoken instructions.

One additional and important weakness is that the intervention only last one week. To change and affect patterns of thoughts could take longer time to have lasting results. Further research should address if a longer intervention results in improvements and also the participants experiences regarding the use of a diary for a longer time period.

Looking back at the test procedure the only group that had a significant improvement in RT (EG 2) was doing their post-test separate from the other groups on a Friday. It is of course possible that some aspect specific for this Friday or the environment where the tests were conducted influenced the participants to react faster than the other groups that were tested on a Tuesday.

More research and repeated studies needs to be done before any generalizations. The power of this study is low; this is because the number of participants was limited to 29.

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Appendix 1

Litteratursökning

Syfte och frågeställningar:

The aim of this study is to evaluate if positive Self-talk (ST) or Self-Reflection (SR) can affect reaction time (RT) in young athletes.

- Does reaction time change within groups after one week intervention with positive self-talk or self reflection?
- Is there a difference in reaction time changes between groups when the positive ST group (EG 1) and the self-reflection group (EG 2) are compared to a control group (CG)?
- How did the athletes experience the intervention?

Vilka sökord har du använt?

<i>Reaction time</i>	<i>Positive psychology</i>	<i>and sport</i>
<i>Complex reaction time</i>	<i>Review mental training</i>	<i>and training</i>
<i>Choice reaction time</i>	<i>Meta analyze mental training</i>	<i>in athletes</i>
<i>Simple reaction time</i>	<i>Self reflection</i>	

Var har du sökt?

GIH:s bibliotekskatalog, PubMed, Sport Discus och Google Scholar

Sökningar som gav relevant resultat

Kommentarer

Mycket litteratur var redan i personlig ägo, rekommenderades av handledare eller återfanns via referenslistorna i redan tillgängliga artiklar.

Appendix 2

Loggbok

Tack för att du vill vara med och bidra till denna studie där idrottares reaktionstid undersöks. Denna loggbok är mycket viktigt för studiens genomförande och jag är väldigt tacksam för din medverkan!

Här kommer några punkter att tänka på när du fyller i loggboken under en vecka. Det finns 7 sidor en för varje dag.

Denna vecka vill jag dig att du tänker positivt om din prestation i samband med träning.

- Jag vill att du skriver ner alla träningspass du genomför. Med träningspass menas inte bara de träningar du utför inom ramen för ditt idrottande utan även om du t ex springer eller motionerar på egen hand samt idrottslektioner i skolan. I loggboken vill jag att du kryssar i den ruta som stämmer bäst överrens med den typ av träning du genomfört. Du **får inte** kryssa i mer än en ruta.
- Jag vill att du efter varje träningspass tänker på positiva tankar du sade till dig själv om din prestation under träningen. Varje kväll under denna vecka ska du skriva ned 3 av dessa positiva tankar.
- Är det en dag då du inte har något träningspass vill jag att du tänker på positiva saker du kan säga till dig själv angående ditt idrottande som helhet, samt skriver ner 3 av dessa på kvällen.
- Kom ihåg att det här är **din** loggbok. För att du skall vara anonym kommer ditt namn aldrig vara sammankopplad med din loggbok. Du kommer att få ett identifikationsnummer som står på loggboken. Resultaten och analysen av loggböckerna kommer handla om effekter på gruppnivå och inte effekter på individuellnivå. Vidare är det som skrivs i loggboken konfidentiellt.
- Bry dig inte om stavning, grammatik eller handstil. Men försök att skriva så att det är läsbart.
- Det är viktigt att du är ärlig och skriver utifrån dig själv.
- Första sidan i loggboken är bara ett exempel på hur en loggbokssida kan se ut.
- Jag vill att du fyller i loggboken **varje kväll** enligt instruktionerna. Utifall att du absolut inte har möjlighet att skriva i din loggbok en av kvällarna, får du fylla i den morgonen efter. OBS! Fyll dock inte i loggboken mer än en dag i efterhand.
- Glöm inte att fylla i veckodag och datum.
- Det är frivilligt att delta och du kan avbryta ditt deltagande under veckan i fall du så önskar. Om detta skulle bli aktuellt kontakta Cecilia Åkesdotter enligt nedanstående kontaktuppgifter.

Om du har några frågor kan du gärna höra av dig till Cecilia Åkesdotter. Hon nås lättast på mail: cissi_ih@hotmail.com eller mobilnummer 073 - 0579928.

När studien är genomförd och analyserad är du välkommen att ta del av mina resultat.

Tusen tack och lycka till!

Exempelsida på en dag i loggboken

LOGGBOK

År: 2011

Månad: april

Dag: 16

Veckodag: tisdag

Beskriv kortfattat din träning under dagen, om du inte har tränat under dagen fyll endast i de positiva saker du har sagt till dig själv angående din träning.

Träningspass 1	Beskriv kortfattat träningspassets innehåll	
Styrka:	X	Lätt styrketräning på morgonen. Jag tränade benböj och bänkpress.
Teknik:		
Uthållighet:		
Annat:		
Hur lång tid tog träningen? Svar: 50 minuter		

Träningspass 2	Beskriv kortfattat träningspassets innehåll	
Styrka:		På kvällen träning med fotbollslaget. Vi tränade teknik i passningar och avslutade med att spela match på småmål.
Teknik:	X	
Uthållighet:		
Annat:		
Hur lång tid tog träningen? Svar: 1 timme och 30 minuter		

Träningspass 3	Beskriv kortfattat träningspassets innehåll	
Styrka:		
Teknik:		
Uthållighet:		
Annat:		
Hur lång tid tog träningen? Svar:		

Positiva saker jag sa till mig själv:
1. Jag är bäst på att hitta lägen att slå passningar
2. Jag är jätteduktig som går upp tidigt och styrketränar, många andra skulle stanna hemma.
3. Bra! Jag är avslappnad och glad under träningen och slösar inte energi på att tänka på annat.

LOGGBOK

Dag 1

År:

Månad:

Dag:

Veckodag:

Beskriv kortfattat din träning under dagen, om du inte har tränat under dagen fyll endast i de positiva saker du har sagt till dig själv angående din träning.

Träningspass 1	Beskriv kortfattat träningspassets innehåll
Styrka:	
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar:	

Träningspass 2	Beskriv kortfattat träningspassets innehåll
Styrka:	
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar:	

Träningspass 3	Beskriv kortfattat träningspassets innehåll
Styrka:	
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar:	

Positiva saker jag sa till mig själv:
1.
2.
3.

Appendix 3

Loggbok

Tack för att du vill vara med och bidra till denna studie där idrottarens reaktionstid undersöks. Denna loggbok är mycket viktigt för studiens genomförande och jag är väldigt tacksam för din medverkan!

Här kommer några punkter att tänka på när du fyller i loggboken under en vecka. Det finns 7 sidor en för varje dag.

Denna vecka vill jag dig att du reflekterar kring din prestation i samband med träning.

- Jag vill att du skriver ner alla träningspass du genomför. Med träningspass menas inte bara de träningar du utför inom ramen för ditt idrottande utan även om du t ex springer eller motionerar på egen hand samt idrottslektioner i skolan. I loggboken vill jag att du kryssar i den ruta som stämmer bäst överrensstämmer med den typ av träning du genomfört. Du **får inte** kryssa i mer än en ruta.
- Jag vill att du efter varje träningspass tänker på vad du kunde ha gjort annorlunda under träningen för att få ut bästa möjliga resultat. Varje kväll under denna vecka ska du skriva ned 3 av dessa förändringar.
- Är det en dag då du inte har något träningspass vill jag att du tänker på hur du kan förbättra ditt idrottande som helhet, samt skriver ner 3 av dessa på kvällen.
- När du har skrivit ner 3 saker vill jag att du fyller i rutan vad du tror en förändring av dessa tre saker skulle leda till.
- Kom ihåg att det här är **din** loggbok. För att du skall vara anonym kommer ditt namn aldrig vara sammankopplad med din loggbok. Du kommer att få ett identifikationsnummer som står på loggboken. Resultaten och analysen av loggböckerna kommer handla om effekter på gruppnivå och inte effekter på individuellnivå. Vidare är det som skrivs i loggboken konfidentiellt.
- Bry dig inte om stavning, grammatik eller handstil. Men försök att skriva så att det är läsbart.
- Det är viktigt att du är ärlig och skriver utifrån dig själv.
- Första sidan i loggboken är bara ett exempel på hur en loggbokssida kan se ut.
- Jag vill att du fyller i loggboken **varje kväll** enligt instruktionerna. Utifall att du absolut inte har möjlighet att skriva i din loggbok en av kvällarna, får du fylla i den morgonen efter. OBS! Fyll dock inte i loggboken mer än en dag i efterhand.
- Glöm inte att fylla i veckodag och datum.
- Det är frivilligt att delta och du kan avbryta ditt deltagande under veckan i fall du så önskar. Om detta skulle bli aktuellt kontakta Cecilia Åkesdotter enligt nedanstående kontaktuppgifter.

Om du har några frågor kan du gärna höra av dig till Cecilia Åkesdotter. Hon nås lättast på mail: cissi_ih@hotmail.com eller mobilnummer 073 - 0579928.

När studien är genomförd och analyserad är du välkommen att ta del av mina resultat.

Tusen tack och lycka till!

Exempelsida på en dag i loggboken

LOGGBOK

År: 2011

Månad: april

Dag: 16

Veckodag: tisdag

Beskriv kortfattat din träning under dagen, om du inte har tränat under dagen fyll enbart i tre saker du kan förbättra inom ditt idrottande och vad dessa förändringar skulle leda till.

Träningspass 1	Beskriv kortfattat träningspassets innehåll	
Styrka:	<input checked="" type="checkbox"/>	Lätt styrketräning på morgonen. Jag tränade benböj och bänkpress.
Teknik:	<input type="checkbox"/>	
Uthållighet:	<input type="checkbox"/>	
Annat:	<input type="checkbox"/>	
Hur lång tid tog träningen? Svar: 50 minuter		

Träningspass 2	Beskriv kortfattat träningspassets innehåll	
Styrka:	<input type="checkbox"/>	På kvällen träning med fotbollslaget. Vi tränade teknik i passningar och avslutade med att spela match på småmål.
Teknik:	<input checked="" type="checkbox"/>	
Uthållighet:	<input type="checkbox"/>	
Annat:	<input type="checkbox"/>	
Hur lång tid tog träningen? Svar: 1 timme och 30 minuter		

Träningspass 3	Beskriv kortfattat träningspassets innehåll	
Styrka:	<input type="checkbox"/>	
Teknik:	<input type="checkbox"/>	
Uthållighet:	<input type="checkbox"/>	
Annat:	<input type="checkbox"/>	
Hur lång tid tog träningen? Svar:		

Tre saker jag kan förbättra i mitt idrottande utifrån dagens träning eller allmänt:
4. Se till att äta ordentligt med mat innan passet
5. Att verkligen koncentra mig under styrketräningen så att jag gör rätt och inte går runt i gymmet och snackar med Anna och Jesper istället för att göra hela träningsprogrammet.
6. Inte glömma vattenflaskan hemma och mobiltelefonen i skåpet i skolan. Det gjorde att jag kom försent till träningen.

Om jag förändrar de tre saker jag har skrivit upp kan det leda till:
Jag orkar träna hela träningspasset och slipper känna mig svag och hungrig. Jag får ut mer av min styrketräning och blir starkare så att jag slipper skador och kan bli snabbare och starkare i fotbollen. Om jag kommer ihåg mina saker slipper jag känna mig stressad och kan vara med på hela träningspasset.

Appendix 4

Loggbok

Tack för att du vill vara med och bidra till denna studie där idrottarens reaktionstid undersöks. Denna loggbok är mycket viktigt för studiens genomförande och jag är väldigt tacksam för din medverkan!

Här kommer några punkter att tänka på när du fyller i loggboken under en vecka. Det finns 7 sidor en för varje dag.

Denna vecka vill jag dig att du tänker på hur mycket av din tid som går till TV-tittande.

- Jag vill att du skriver ner alla träningspass du genomför. Med träningspass menas inte bara de träningar du utför inom ramen för ditt idrottande utan även om du t ex springer eller motionerar på egen hand samt idrottslektioner i skolan. I loggboken vill jag att du kryssar i den ruta som stämmer bäst överrensstämmer med den typ av träning du genomfört. Du **får inte** kryssa i mer än en ruta.
- Jag vill att du efter varje dags slut skriver ned hur lång tid du har tittat på TV samt vilket/vilka program du har tittat på.
- Med TV-tittande avses den tid som du spenderar att titta på det som sänds via TV-kanaler, både kommersiella och statliga. Inkludera även den tid du spenderar tittandes på det som sänts på TV-kanaler via internet, till exempel SVT-play.
- Är det en dag du inte har tittat på TV skriver du ner det. Antal timmar blir i detta fall 0.
- Kom ihåg att det här är **din** loggbok. För att du skall vara anonym kommer ditt namn aldrig vara sammankopplad med din loggbok. Du kommer att få ett identifikationsnummer som står på loggboken. Resultaten och analysen av loggböckerna kommer handla om effekter på gruppnivå och inte effekter på individuellnivå. Vidare är det som skrivs i loggboken konfidentiellt.
- Bry dig inte om stavning, grammatik eller handstil. Men försök att skriva så att det är läsbart.
- Det är viktigt att du är ärlig och skriver utifrån dig själv.
- Första sidan i loggboken är bara ett exempel på hur en loggbokssida kan se ut.
- Jag vill att du fyller i loggboken **varje kväll** enligt instruktionerna. Utifall att du absolut inte har möjlighet att skriva i din loggbok en av kvällarna, får du fylla i den morgonen efter. OBS! Fyll dock inte i loggboken mer än en dag i efterhand.
- Glöm inte att fylla i veckodag och datum.
- Det är frivilligt att delta och du kan avbryta ditt deltagande under veckan i fall du så önskar. Om detta skulle bli aktuellt kontakta Cecilia Åkesdotter enligt nedanstående kontaktuppgifter.

Om du har några frågor kan du gärna höra av dig till Cecilia Åkesdotter. Hon nås lättast på mail: cissi_ih@hotmail.com eller mobilnummer 073 - 0579928.

När studien är genomförd och analyserad är du välkommen att ta del av mina resultat.

Tusen tack och lycka till!

Exempelsida på en dag i loggboken

LOGGBOK

År: 2011

Månad: april

Dag: 16

Veckodag: tisdag

Beskriv kortfattat din träning under dagen, om du inte har tränat under dagen fyll enbart i TV-tittandet längre ner på sidan.

Träningspass 1	Beskriv kortfattat träningspassets innehåll
Styrka:	X Lätt styrketräning på morgonen. Jag tränade benböj och bänkprens.
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar: 50 minuter	

Träningspass 2	Beskriv kortfattat träningspassets innehåll
Styrka:	På kvällen träning med fotbollslaget. Vi tränade teknik i passningar och avslutade med att spela match på småmål.
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar: 1 timme och 30 minuter	

Träningspass 3	Beskriv kortfattat träningspassets innehåll
Styrka:	
Teknik:	
Uthållighet:	
Annat:	
Hur lång tid tog träningen? Svar:	

Hur länge har du tittat på TV idag? Svar: tre timmar och 20 minuter
Vilka program, filmer eller klipp har du tittat på? Nyhetsmorgon Happy Feet; en tecknad film om pingviner

Appendix 5

Muntliga instruktioner TEST AV REAKTIONSTID

Innan testet

Välkommen, du kommer att få ett papper med skriftliga instruktioner att läsa igenom, om du har några frågor går det bra att ställa dem när du har läst klart. Innan dess vill jag att du stänger av din mobil så att ljudet inte stör dej under testet.

Testdeltagaren läser instruktioner

Har du hunnit läsa igenom instruktionerna?

Har du några frågor?

Jag kommer att säga till när testet startar. Jag kommer att komma fram till dig när du räckt upp din hand för att testet är slut. Avbryt ej testet.

Nu börjar testet!

Mellan testen

Jag får be dej att flytta dej från datorn så jag kan spara dina resultat, du kommer inte att få dina resultat nu. Men om du vill kan du få reda på dem efteråt när undersökningen är helt färdig.

Under tiden är det bra om du läser igenom de instruktionerna för test nummer två. Om du har några frågor går det bra att ställa dem när du har läst klart.

Testdeltagaren läser instruktioner

Har du hunnit läsa igenom instruktionerna?

Har du några frågor?

Jag kommer att säga till när testet startar. Jag kommer att komma fram till dig när du räckt upp din hand för att testet är slut. Avbryt ej testet.

Nu börjar testet!

Efter testet

Jag får be dej att flytta dej från datorn så jag kan spara dina resultat.

Tack för din medverkan!

Appendix 6

REAKTIONSTID

Du kommer att använda ett datorprogram som testar din reaktionstid. Du kommer att få göra två olika typer av reaktionstest. När du har genomfört det första testet kommer du få utförligare instruktioner för att genomföra test nummer två. Sammanlagt kommer ditt deltagande att ta ca 10 minuter.

Test 1:

På skärmen framför dig kommer du att se åtta cirklar. Inuti varje cirkel finns en bokstav. Placera höger eller vänster pekfinger på tangenten H. Din uppgift är att trycka på tangenten H så fort du kan. Du ska trycka varje gång du ser att cirkeln med (bokstaven H) blir svart. Om du råkar trycka för tidigt eller missa en signal fortsätt att genomföra hela testet. När testet är slut kommer en dialogruta att visas och datorn kommer att göra ett pipande ljud. Tryck då inte på några fler tangenter. Räck upp handen för att indikera att testet är avklarat. Du kommer att bli tillsagd när testet startar.

LYCKA TILL!

Test 2:

På skärmen framför dig kommer du att se åtta cirklar. Inuti varje cirkel finns en bokstav. Placera vänster långfinger på bokstaven D, vänster pekfinger på bokstaven F, höger pekfinger på bokstaven H och höger långfinger på bokstaven J. Din uppgift är att så fort du kan trycka på tangenten för D, F, H, eller J beroende på vilken cirkel som blir svart. T ex. om cirkeln med J blir svart så skall du trycka på tangenten J så snabbt som möjligt. Reagera så snabbt du kan, men var säker på att du trycker på rätt tangent. Om du råkar, trycka för tidigt, trycka på fel tangent eller missa en signal fortsätt att genomföra hela testet. När testet är slut kommer en dialogruta visas. Tryck då inte på några fler tangenter. Räck upp handen för att indikera att testet är avklarat.

Du kommer att bli tillsagd när testet startar.

LYCKA TILL!

Appendix 7

Nr på loggboken: _____

Frågor!

Vilken eller vilka idrotter har du utövat regelbundet under de senaste fem åren?

Vilken är den idrott du idag ägnar mest tid åt under en genomsnittlig vecka?

Hur många år har du varit aktiv inom denna idrott?

_____ år.

Hur många träningspass tränar du en genomsnittlig vecka, inkludera idrottslektioner och all typ av idrott?

_____ pass.

Vilka mål har du inom din idrott?

Är du vänster eller högerhänt?

Vänster Höger

Hur tyckte du det var att fylla i loggboken under en vecka?

Mycket givande

Givande

Varken eller

Inte alls givande

Tror du dagboken kan ha en påverkan på din idrottsprestation?

Mycket

En del

Lite

Inte alls

Har du några kommentarer till ditt deltagande i studien, skriv gärna ned dem här
