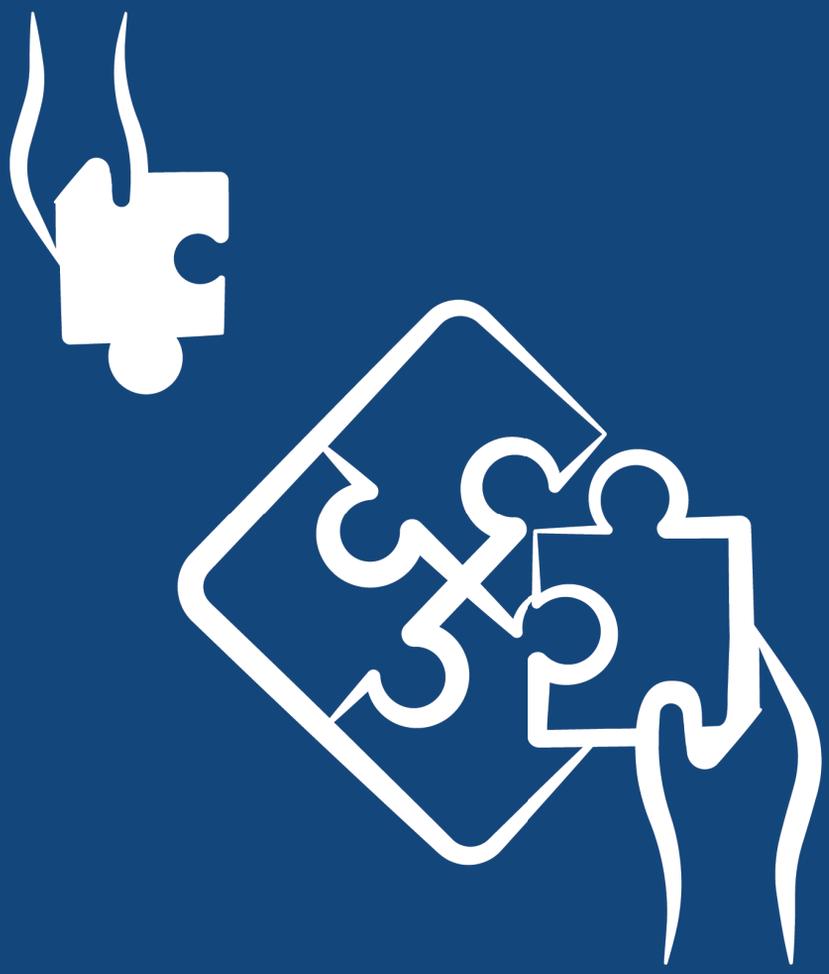

Master thesis

Boost Communication on Mental Self-Reflection

in KNSB Talent Teams

Sophia van der Laan
Design for Interaction
Delft University of Technology

Colophon

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Master thesis
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Faculty of Industrial Design Engineering
Delft University of Technology

In collaboration with
Innovatielab Thialf

Author
Sophia van der Laan
Student number 4676904

Graduation committee
Asst. Prof. dr. Jos J. Kraal
Prof. dr. Pieter Jan Stappers
Asst. Prof. dr. Eline van der Kruk

Company mentors
Berber Bergsma
Inge Stoter

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All the best,
Sophia

Summary

The aim of this Master's thesis is to determine how user engagement and motivation can be improved when using the Athlete Management System (AMS) as a monitoring system. This system monitors athletes subjectively and objectively for short and long-term progress. Increased use of this monitoring system will result in a more complete and valuable data set for coaches to identify the risks of under- or overtraining for KNSB talented athletes in both long and short-track disciplines.

Several interviews were conducted with athletes, experts from the KNSB Talent Teams (KTTs), and other experts in the field of AMS, sports psychology, and sports innovation centers. These interviews were used to explore how the target group reflected on their sports' progression and how the feedback process from the KTT staff played a role in this, supported by a literature review of related topics in the context of the project aim.

After interviews with athletes, coaches, and embedded scientists, potential design directions were identified and one was selected by evaluating the directions for feasibility and impact concerning the project aim. The chosen design opportunity is to improve communication about AMS between athletes and their coaches and to provide more guidance in an athlete's reflective process when they need to measure their recovery-stress state of 'Mental Readiness' in AMS, which can be described as the athlete's ability to concentrate on the execution of a training session. Measuring the recovery-stress state of an athlete can help identify the risk of under- or overtraining. Athletes and coaches experience difficulties interpreting and assessing 'Mental Readiness'.

Brainstorming and concept validation sessions are conducted to develop a final design: a workshop session consisting of a presentation with three assignments to allow athletes and their coach to share their interpretations of the 'Mental Readiness' scale and to give first steps of guidance on how to reflect as an athlete on this scale. The final design is an addition to the kick-off meeting at the beginning of the speed skating season. It also proposes a roadmap for the long-term implementation of the final design in the context of the target group, including additional suggestions for other workshops and presentations to improve communication and behavior around AMS based on the insights from the interviews.

Further research should investigate how the final design leads to behavioral changes in user engagement and motivation in long-term implementation. In addition, other aspects of the recovery-stress state, such as 'emotional state' and 'motivation', could be explored to broaden the communication and enhance the self-reflection of the athlete. In future research, it is important to expand guidance for athletes in their reflective capacity and for KTT staff in the correct interpretation and next steps when receiving 'Mental Readiness' data. This will help to motivate athletes to work with the final design and increase user engagement with the Athlete Management System.

Glossary

- **KNSB:** Koninklijke Nederlandse Schaats Bond
- **NOC*NSF:** Overarching Dutch Sports Federations
- **KTT:** KNSB Talent Team
- **ST:** Short Track
- **LT:** Long Track
- **AMS:** Athlete Management System
- **OTS:** Overtraining Syndrome
- **ARSS:** Acute Recovery & Stress Scale
- **SRSS:** Short Recovery & Stress Scale
- **RPE:** Rate of perceived exertion
- **MVP:** Minimum Viable Product

Content

1. The Scope

This chapter introduces the starting point of this project and states the defined aim. In 1.1. the project will be introduced by the history of speedskating, the client Innovatielab Thialf, and a monitoring system called 'Teamworks AMS' that will be used during this project. In 1.2. the context and background information on the target group is given. In 1.3. the project focus is described and how the problem definition is transformed into a project aim. Lastly, in 1.4. the structure of the project and this master thesis is explained by 'The double diamond' method.

1.1 Project Introduction

1.1.1 History of Speedskating & Athlete Management System

Speed skating originated in the Netherlands and Scandinavia as far back as the 13th century. The purpose was to maintain communication between villages. It quickly became part of the Dutch culture and in the 19th century, the first races were organized (Olympics, n.d.). Worldwide, the Netherlands is known for the `Elfstedentocht' speedskating competition and our innovations in speed skating (Bull, A. (2023, 5 maart)). The sport is centered in Heerenveen, where Innovatielab Thialf improves sports performance and experience by collaborating with companies, governments, and universities (Innovatielab Thialf, n.d.). One of the benefits of this collaboration is that they have access to the latest technologies.

Figure 1: Screenshots of the Athlete Monitoring System called Teamworks AMS

Within the Koninklijke Nederlandse Schaatsbond or KNSB (read: Royal Dutch Speed Skating Federation), a monitoring system called Teamworks AMS (Athlete Management System) is used to monitor the athletes subjectively and objectively on short and long-term progress. This is done through daily Questionnaires to check the health of the athletes, but also to store race times or test results. An example of the application is shown in Figure 1.

During the project, the choice of monitoring system was changed from SmartaBase to Teamworks AMS. As a result, the research and project set-up was carried out using the SmartaBase application. The final design was tested using the newly implemented Teamworks AMS application. The functionalities of the applications remained largely unchanged and only affected the project outcomes in terms of knowing where to find things in the application.

1.1.2 Innovatielab Thialf

The project is carried out in collaboration with Innovatielab Thialf, which has been in existence since July 2017. They combine business, science, and sport to achieve innovation, as illustrated in Figure 2. The Innovatielab consists of embedded scientists, experts in data analysis who are the heart of the foundation, assisted by students. They work together on innovations in speed skating disciplines and provide personal feedback to athletes and coaches.

The Innovatielab conducts research into athletes' perceptions and experiences of monitoring. They work with the NOC*NSF (the overarching Dutch sports federations) and the KNSB to implement innovations in the monitoring tools, such as Teamworks AMS.

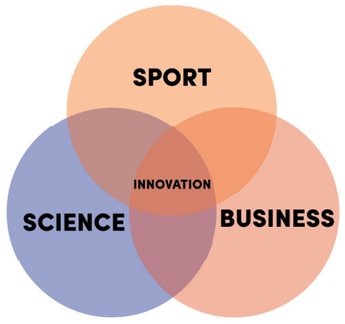


Figure 2: Combination of business, science, and sport to create innovation

Besides the Innovatielab, there are research projects of NOC*NSF and KNSB, which stimulate innovation in terms of digitalization or new interventions in monitoring tools. Two of those research project are discussed here after.

Research projects of NOC*NSF & KNSB
Since September 2017, the project 'Digitalisatie schaatssport' (read: digitalization of speed skating) has been launched, which means the start of the implementation of the athlete management system in the Dutch top sport (Voortgang Programma Digitalisering Topsport - NOCNSF, z.d.)).

Building upon this, 'Coach-in-control' is a project started in April 2020, with the main objective of improving the monitoring of athletes. Coaches often rely on embedded scientists to translate and combine the information of internal and external load to make training adjustments. This project worked on the development of coach training and a dashboard to improve training guidance towards coaches to detect and prevent early stages of overtraining of athletes (Coach in control | Thialf. (z.d.)).

1.2 Project Context

1.2.1 KNSB Talent Teams & Overtraining Syndrome

The definition of topsport is described in Figure 3 and means that being a topsporter requires a lot of energy and training for a body to compete on the highest level.

KNSB Talent Teams
The target group of this project, known as KNSB Talent Teams (KTT), is spread throughout the Netherlands to offer the teams the best possible combination of top-level sport and education, close to home and in a professional environment (KNSB Talent Teams (z.d.).).

KTTs are competing in one of the six KNSB disciplines. The competition category for long track, marathon, and short track, is based on your age (Wedstrijdcategorieën. (z.d.)). Classifying yourself as a Senior is from the age of 23*. Juniors are aged between 13-18* and neo-seniors are aged from 19 to 22*. KTTs are springboards toward the senior top. Therefore the age group of KTTs varies from 16-22 years.

**Exceptions are made if the participant is born after the first of July (Wedstrijdcategorieën. (z.d.)).*

Overtraining Syndrome
Athletes in KTTs are in the age range that top sport and study develop at the same time in life. It should be avoided as much as possible that one comes at the expense of the other. In other words, athletes feel obliged to either end their top-level sports career or their studies prematurely (Blom, S., & Duijvestijn, P. (2008)).

Athletes in KTTs train every day to improve their performance. Training loads are raised to boost performance. Training periodization is the only way to endure increased loads and it involves alternating periods of rest and recuperation. Overreaching is defined as a build-up of training load that results in performance declines taking several days to recuperate from. In the end, performance gains may result from pushing yourself too far and getting enough rest. However, overtraining syndrome (OTS) may develop if overreaching is severe and coupled with another stressor, such as studying. Preventing overtraining can be done by monitoring and education of athletes (Kreher & Schwartz, 2012).

Definition of top sport:

*"Top sport is practicing a sport at the highest level, nationally or internationally. It differs from purely recreational sport and general competitive sport in that the emphasis is almost entirely on performance."**

*(Topsport Nederlands Woordenboek - Woorden.org, z.d.))

Figure 3: Definition of top sport

1.2.2 Top Sport Status & Talent Development

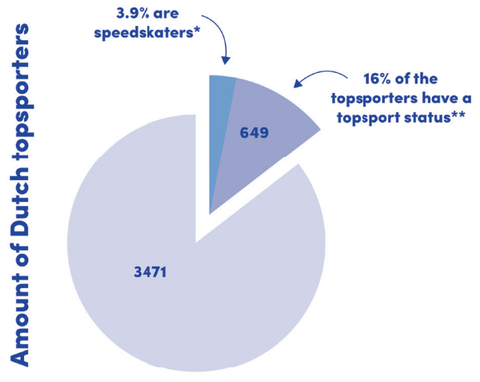
Top Sport Status

Given the popularity of speed skating in the Netherlands, the KNSB calculated that 1.5% of Dutch people participated in weekly speed skating in 2020 (Instituut schaatsen en Inlineskaten in Nederlands (2020)), as shown in Figure 4. Those who compete internationally at the highest senior level in a recognized top sport discipline are granted top sport status by the NOC*NSF.

A study by KNSB in **2020** found that **1.5%** of the Dutch population (12 years and older) participate in **speed skating every week**, which is about **214,000 people** (Instituut schaatsen en Inlineskaten in Nederland (2020)).

Figure 4: Total number of Dutch speed skaters in all disciplines.

A study by the Mulier Institute in 2022 did research on the amount of Dutch top sporters. In total, there are 4120 Dutch top sport athletes in 2022 as shown in Figure 5. Almost 650 (non-) Olympic sporters have a top sport status in all sports disciplines affiliated to NOC*NSF (Dopheide, M. Out, K. Balk, L. (2022)), and only 159 participate in the speedskating discipline. This reflects the small group in which the context is set.



*4 disciplines are presented: Total (159),Long Track (110), Short Track (36), Figure Skating (6) & Marathon (7)

**Top athletes with an Olympic or non-Olympic discipline (excluding Paralympic) with immediate A, HP or selection status from NOC*NSF (2021) (Topsportstatussen - NOCNSF, z.d.)).

Figure 5: Dutch top sporters who are officially classified with a top sport status

Talent Development

A new talent needs certain qualities to become a top sporter. Those qualities are split up into six categories illustrated in Figure 6.

Figure 6: Talent profile of needed qualities to become a new talent

In the KNSB's multi-year plan, there are different phases according to age in which talent can be developed. The KTTs are focused on the last three phases and allow coaches to create an optimal learning environment for learning competencies and skills on a mental, psychical, technical, and tactical level that underpin the four pillars of the KNSB (Beleid Talentherkenning En -ontwikkeling | KNSB, n.d.)), shown in Figure 7.

Fases MJOP KNSB	Langebaan & Inline-Skaten & Shorttrack		Kunstrijden	
Leeftijd	V	M	V	M
FUNdament	4 - 8	4 - 9	3 - 5	3 - 5
Leren Schaatsen/ Skaten	8 - 11	9 - 12	5 - 8	5 - 9
Leren Trainen	11 - 15	12 - 16	8 - 11	9 - 12
Train Trainen	15 - 17	16 - 18	11 - 13	12 - 14
Trainen om te Presteren	17 - 23	18 - 23	13 - 18	14 - 18
Trainen voor de Top	19+	19+	16+	16+

Figure 7: Phases of the KNSB's multi-year plan for the development of talent as focus areas.

An expert on athlete monitoring indicated that the KNSB has identified four pillars that support KTTs as a guideline for working towards the Senior Top. The focus in a KTT is based on learning, where some pillars are more important in some disciplines than others and differ between disciplines. As an example, in short track (ST) technique & strategy are important pillars to discuss position in race and when to overtake. Long Track (LT), on the other hand, focuses on how to perform under pressure and mental attitude, assessing physical condition and how to approach a race distance as a strategic focus. Performance is the result of combining all the pillars to make it to the top, as shown in Figure 8.

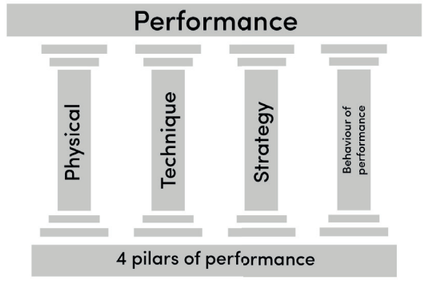


Figure 8: Four pillars that support KTTs to work towards performance and ultimately to the top

1.3 Project Focus

1.3.1 Problem Definition

Teamworks AMS is primarily built for coaches and other staff members to get insight into athlete monitoring and to evaluate their program. The KNSB has been facilitating this for several years and has together with the NOC*NSF, built dashboards for coaches and other staff members.

In Teamworks AMS a dashboard can be found where athletes can get insights into their data. However, in an evaluation of the system, the athletes pointed out that they would like to have more insights into their own sports development.

Besides that, research from Kerkhoff, M., Stoter, I., & Otter, R. (2022) investigated that athletes don't regularly fill in health data in the AMS application. This has resulted in coaches not having consistent data on the health conditions of their athletes. Topsport is all about sports performance and pushing athletes in training load. A potential cause of the overtraining syndrome (1.2.1.) may be unrecognized errors in the execution of the training program by the athletes (Foster, C. et al (2001)).

Involving the athletes more in their development as top sports athletes with the help of innovations in the digitization of monitoring tools such as AMS can help in preventing the overtraining syndrome and give more individual training programs (Digitalisatie Schaatssport | Thialf, z.d.)).

The start of this project is to investigate the current view of athletes regarding the use of this athlete monitoring system and how it will stay relevant in the long term. The target group is mainly the talented athletes of KTTs, referred to as 'athletes' in this master thesis.

Therefore, the aim of this project is stated as follows:

"The aim is to increase user engagement & motivation for the Athlete Management System by designing how the reflection process should work for junior athletes and their coaches when evaluating health conditions. The goal is to have a more complete and valuable data set to improve the performance and development of top athletes and prevent injuries or overtraining."

1.4 Project Approach

The structure of the research and report is based on the 'Double Diamond framework' (Design Council, n.d.). This framework consists of four phases: Discover, Define, Deliver, and Develop. A brief explanation of each phase, methodologies and the activities undertaken can be found in this chapter.

Key takeaway
To structure the process, the double diamond phase is used to carry out activities to arrive at the key findings and conclusions of the final design. This chapter explains which activities were carried out and the methods used. The following chapters explain the results of the activities carried out.

1.4.1 Double Diamond structure

The Double Diamond, as the name suggests, is divided into two diamonds, as shown in Figure 9. The diamonds correspond to a design process methodology by having a research and a design phase. A diamond consists of diverging and converging phases. In diverging, knowledge and ideas are generated. In converging, the input is evaluated and conclusions and insights are drawn. The first diamond explores the context of the KTTs and the research related to that context. The second diamond explores the designs in the given context.

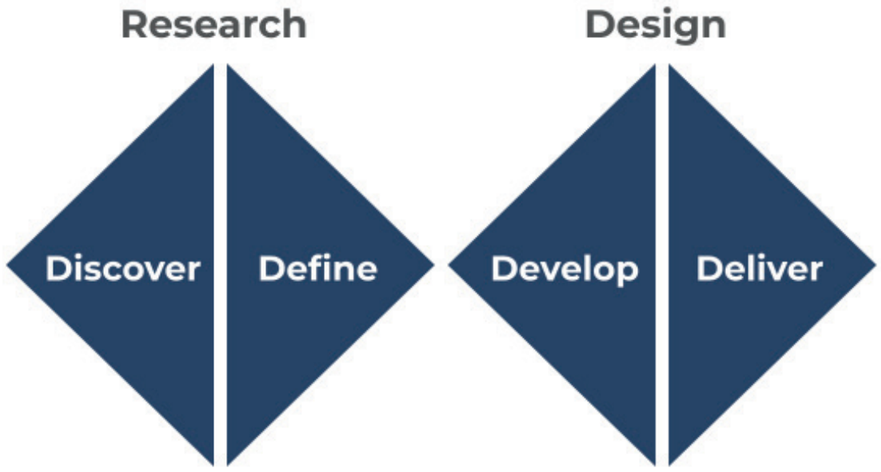


Figure 9: Double diamond framework

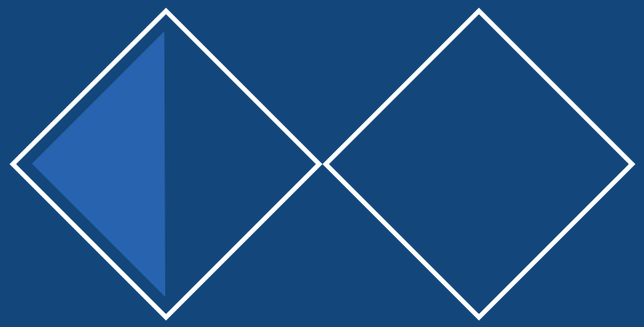
Research diamond
The activities carried out in each diamond are using different methodologies. In addition to these research activities, books, papers, events attended, videos, or other media platforms were studied to complete the data.

Discover
The aim stated at the beginning is formulated in several sub-research questions to search for literature in the area of the stated aim and the given context. Observing the target group in their daily routine and analyzing their behavior within the KTT and the monitoring tools they use has provided a lot of insight into the possibilities and limitations of the project. Furthermore, the analysis of the monitoring platforms in terms of user interactions and information provided helps to understand the design possibilities. Conducting interviews with experts within and outside a KTT allowed the researcher to use the observations and input from the literature review as a basis for the interviews with the target group. The method used for the target audience interviews was based on Visser, F.S., et al.'s (2005) context mapping tool for conducting qualitative research.

Define
Insights from the Discover phase are clustered and mapped by categorizing the interviews into five categories: Who, Tools, Data, Feedback, and Moment of Reflection. The results lead to possible design opportunities and are evaluated using a C-box. One design opportunity is selected and ranked in terms of impact and viability. This opportunity is transformed into a design goal, including a list of requirements and wishes. An interaction vision is also generated to provide an analogy for how the interaction should feel with the design created in the next diamond.

Design diamond
Develop
Ideation was carried out through brainstorming sessions and concept validation sessions to propose initial ideas and lead to concept development. These brainstorming sessions use the How-tos method (Van Boeijen, A., et al. (2014)), where ideas are clustered by hits & dots (Heijne & Van der Meer, (2019)) to propose two concepts. A lo-fi prototype is made and the two concepts are validated on a Harris profile (Van Boeijen, A. et al, (2020)) to choose one of the concepts. The chosen concept is developed in a better Lo-Fi prototype and elements of this prototype are validated with the target group and experts using Minimum Viable Products (Van Boeijen, A., et al. (2020)).

Deliver
In the final stage, the concept is translated from the improvements in the Develop phase into a high-fidelity prototype and used to test the design for viability, desirability, and feasibility through one final validation session. Once the final design has been validated, a conclusion is drawn for succeeding in the project aim, long long-term implementations and recommendations are suggested for future use.



2. Discover

This chapter introduces the first diamond, called the 'Discover' phase. It focuses on understanding the context and the target group in the given situation, by gathering relevant information around the aim of the project. It involves talking to and spending time with the target group to find out where the problem lies. The first section in 2.1. explains the research question, including the sub-research questions for carrying out research activities. The sections that will follow present the results of the activities carried out in 2.2. Ending the chapter in 2.3 with the key findings to take into account in the next chapter.

2.1 Research Approach

This section presents the research aim and is broken down into sub-questions to provide guidance on how to answer the research question and to help identify which experts to involve.

2.1.1 Research Question

Innovatielab Thialf wants to involve athletes more in their own development as top athletes. Preferably in a digital environment through the use of monitoring tools such as AMS to provide insight into performance and to guide training programmes more easily ((Digitalisatie Schaatssport | Thialf, z.d.)). The starting point for the research was therefore the aim stated in 1.3.1 and repeated here:

"The aim is to increase user engagement & motivation for the Athlete Management System by designing how the reflection process should work for junior athletes and their coaches when evaluating health conditions. The goal is to have a more complete and valuable data set to improve the performance and development of top athletes and prevent injuries or overtraining."

In exploring the aim and context of use described above, a number of sub-research questions are formulated, which are attempted to be answered in the following sections.

1. How does the KNSB's Talented Teams currently work and what is the role of the Athlete Management System in this context?
2. How are other monitoring systems used in practice and in relation to the Athlete Management System?
3. What literature is used to quantify the physical and mental health of athletes & how is this used in the Athlete Management System?
4. How does a talented athlete reflect on his or her current health status? And what literature applies reflection?
5. What research has been already on monitoring and has it been applied in other sports disciplines?

2.1.2 Experts Involved

The research activities are carried out with the help of the experts listed hereafter:

- Embedded scientists of Innovatielab
- Coaches of KNSB talent teams
- Athletes of KNSB talent teams
- Project manager of Innovatielab Thialf
- Project manager of Sailing Innovation Center
- Sports psychologist of NOC*NSF
- Teamworks AMS expert of NOC*NSF
- PhD candidate of TU Delft with expertise on data and control over personal data

2.2 Research Results

The sub-questions described in 2.1.1 are answered by carrying out activities such as literature review, observation of the target group and observation of monitoring tools, interviews with experts and finally interviews with the target group. This section presents the results of the activities carried out.

2.2.1 Monitoring systems used in KNSB Talent Teams

In this section sub-questions number one and two are answered about how a KTT works and what is the role of the AMS system in the context used and if there are also other monitoring systems involved in the context of a KTT by observing the target group and searching the internet for more background information about the other monitoring systems. Furthermore, the participation in a workshop day of the RUG of Groningen with embedded scientist students and the project manager of Thialf also gave insight into the questions.

1. How does the KNSB Talented Teams currently work and what is the role of the Athlete Management System in this context?
2. How are other monitoring systems used in practice and in relation to the Athlete Management System?

The first chapter of this thesis gives an introduction to the KNSB's Talented Teams (1.2.1.). In this chapter, the topic of what the role of the Athlete Management System is and how it relates to other monitoring systems is explored.

The overall aim of monitoring is to prevent injury or overtraining and to encourage more training. Monitoring systems can be a valuable resource if used well. 20 years ago this was based on the skills of the coach (Van Loon, J. (2021)). Today, due to the increase in technology, many new monitoring systems are being introduced to the market. A brief description of each of the monitoring systems used in KTTs to analyse mental and physical data is given hereafter.

Athlete Managment System (AMS)

Figure 10: Teamworks AMS

Function: To monitor athletes subjectively and objectively for short or long term progress. Used in all federations that are members of NOC*NSF, which provides federations with experts in this monitoring system. AMS guarantees security with regard to AVG regulations and has more design freedom compared to Trainingpeaks to create your own design in the application for dashboards or daily logs using components of the application. The logo of the AMS application is shown in Figure 10.

Use in context: Athletes use the AMS system for digital testing (Wellness & RPE Questionnaires, logbooks) and can view feedback or results of physical testing (Wingate, Counter Movement Jump test, lap times and more) on a mobile application or tablet. Coaches can view the results of the athlete's entries in digital and physical tests on a laptop, mobile phone or tablet.

Development of AMS: Since the introduction of AMS in the 2022 KTTs, new updates to the system will be presented and explained at a kick-off meeting at the start of each season. It's also evaluated every year with a Questionnaire for athletes and coaches. It is important to note that the KTT will switch from SmartaBase to Teamworks AMS from the 2023/2024 season to the 2024/2025 season. This means that the interviews in the Discover phase is done with SmartaBase and the final design is tested with Teamworks AMS.

Athlete touchpoints with AMS

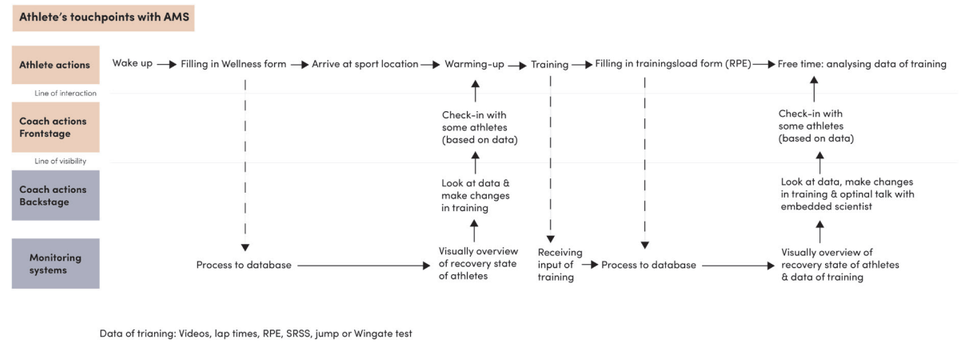


Figure 11: Athlete touchpoints with AMS

Digital tests such as the Wellness Questionnaire should be completed each day before the start of training and the Rate of Perceived Exertion (RPE) should be completed within 30 minutes of training, as shown in Figure 11 to visalise the touch points of the Questionnaires in AMS. A line of visibility is drawn to show what happens to the athlete's data input by the coach and the application. These processes behind the line of visibility should be clear to athletes so that they can see the added value of using monitoring systems to analyse their mental or physical data.

The section on 'other monitoring systems used in KTTs' can be found in the confidential appendix.

Key take-away

- AMS is used to monitor athletes subjectively and objectively for short or long term progress. The KTT will switch from SmartaBase to Teamworks AMS from the 2023/2024 season to the 2024/2025 season. This means that the interviews conducted in the Discover phase is done with SmartaBase and the final design is tested with AMS.
- Many monitoring systems are used to monitor an athlete. It's important to use the strengths of each system and make them work in harmony to get the most out of the monitoring systems of efficient data analysis.
- The AMS is still in development and will be evaluated annually using a Questionnaire and new updates will be explained to athletes and coaches in a kick-off meeting at the beginning of the season.

2.2.2 How to measure the recovery-stress state & be able to reflect as athlete

This section answers sub-questions number three and four about how an athlete reflects on their health status and what type of literature stimulates reflection in this area. The literature on quantifying physical and mental health status in relation to AMS is discussed. Talking to embedded scientists gave more insight into the literature behind quantifying physical and mental health and how this is applied in AMS by observing the application and the target group when they have to use the application. This literature provided the starting point from which the Questionnaires in the AMS application were developed. Furthermore, exploring theories from psychological models related to reflection gives an idea of how reflection models from the literature are applied in practice to make it concrete for users to reflect on themselves.

3. What literature is used to quantify the physical and mental health of athletes & how is this used in the Athlete Management System?
4. How does a talented athlete reflect on his or her current health status? And what literature applies reflection?

When an athlete has the ability to reflect on their mental and physical health, it's easier to measure recovery and how training loads can be applied to an individual. However, in order to create this ability, it is necessary to delve deeper into the theories of psychology that use an individual's reflective model to support self-reflection and ultimately create training programmes based on one's own reflective ability.

Gibb's reflective cycle
Gibb's reflective cycle helps in reflection to learn from experience, shown in figure 12. The framework allows you to build on experiences and naturally lends itself to a cycle of iterating on experiences, learning and planning from things that went well and things that didn't (Gibbs' Reflective Cycle, 2020). This model can help you to learn from experiences of measuring your health status in training and to develop your own reference for reflecting on this status.

- Description of the experience
- Feelings and thoughts about the experience
- Evaluation of the experience, both good and bad
- Analysis to make sense of the situation
- Conclusion about what you learned and what you could have done differently
- Action plan for how you would deal with similar situations in the future, or general changes you might find appropriate.

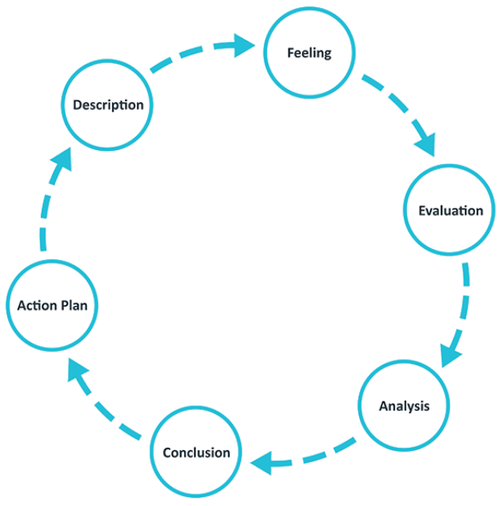


Figure 12: Gibbs' reflective cycle

Signaling plan
A Dutch psychological model for early recognition of a crisis, in the case of this project overtraining, is called the Signaleringsplan (n.d.). The plan contains specific open-ended questions about what a person signals when they feel good or when they are in crisis. The plan helps you to think about what you notice yourself and what others notice, and what kind of help you can offer yourself or others.

An expert in sport psychology indicated that two steps are important to consider when implementing such a model. Firstly, the athlete's reflective capacity should be indicated; if there is less experience of reflection, support should be explored to help the athlete's reflective capacity to grow, by providing guidance in answering the questions or giving examples. Secondly, the next steps for staff are important in order to gain confidence in the operation of the model and in the AMS application. An example of the model is shown in Figure 13.

Preventing overtraining and recognising the signals that can lead to overtraining is an important reflective skill to have and is therefore used in this Master's thesis as inspiration for the Develop chapter of the Double Diamond. Preventing overtraining and recognising the signals that can lead to overtraining is an important reflective skill to have.

Fase 0: Als ik mij goed voel	Waar merk ik dat zelf aan? Waar merken anderen dat aan?	Wat kan ik daar zelf aan doen? Wat kunnen anderen daaraan doen? Vrienden: Familie: Hulpverleners
Fase 1: Als ik mij minder goed voel	Waar merk ik dat zelf aan? Waar merken anderen dat aan?	Wat kan ik daar zelf aan doen? Wat kunnen anderen daaraan doen? Vrienden: Familie: Hulpverleners:
Fase 2: Als ik mij niet goed voel	Waar merk ik dat zelf aan? Waar merken anderen dat aan?	Wat kan ik daar zelf aan doen? Wat kunnen anderen daaraan doen? Vrienden: Familie: Hulpverleners:
Fase 3: Als ik in crisis verkeer	Waar merk ik dat zelf aan? Waar merken anderen dat aan?.	Wat kan ik daar zelf aan doen? Wat kunnen anderen daaraan doen? Vrienden: Familie: Hulpverleners:
In geval van crisis mogen jullie contact opnemen met		

Figure 13: Signaling plan template

SRSS

Implementation of SRSS

The athlete's perceived state of recovery from training load is measured in AMS by the SRSS (Short Recovery & Stress Scale) Questionnaire, which is based on the literature of Kellmann (2010), who states that overtraining can be prevented by performing the test and analysing the results correctly. Several experts in the field of top-level sport indicated that the SRSS Questionnaire is commonly used in several NOC*NSF sports federations, such as speed skating, sailing and cycling.

The SRSS Questionnaire contains 8 items that assess your Recovery and Stress dimensions, shown in Figure 14, on a Likert scale from 1 to 6. It should be completed before you start training and takes less than 1 minute to complete. High scores on the stress scales reflect subjective stress, whereas high scores on the recovery scales indicate good recovery (Kellmann, 2010)). An expert from the NOC*NSF in AMS pointed out that the Likert scale is used in practice from 1 to 10 in order to make it easier for Dutch athletes to relate to a scale that is more familiar to them.

An expert in analysing athlete data for coaches pointed out that coaches get a change of colour in their athlete dashboards when there is a difference in results. This means that if an athlete deviates from their individual average, the intensity of the colour changes to positive (green), negative (red) or grey (the average is the same for 6 days) depending on the size of the deviation.

RestQ 76 items
↓
ARSS 32 items
↓
SRSS 8 items

SRSS

Recovery dimension	Stress dimension
Physical Performance Capability	Muscular Stress
Mental Performance Capability	Lack of Activation
Emotional Balance	Negative Emotional State
Overall Recovery	Overall Stress

Figure 14: Type of data gathered from SRSS test

Origin of SRSS

The SRSS Questionnaire is derived from the RestQ Questionnaire, which contains 77 items to access the recovery-stress state of an athlete, indicating the extent to which the individual is physically and/or mentally stressed and whether or not the individual is able to use individual strategies to recover. High scores on the stress scales reflect high stress, whereas high scores on the recovery scales reflect good recovery. A Likert scale from 0 (never) to 6 (always) is used and the participant is asked to indicate how often they have used each statement in the last 3 days. It is important to realise that the RestQ Questionnaire only represents a short period of time in an individual's life, which can change radically in a matter of days, and therefore the correct time or training should always be taken into account when analysing the data (Kellmann, 2010 & Kellmann, M.; Kallus, K.W. (2001).

The regular use of the RestQ-sport Questionnaire as a monitoring tool can be challenging to obtain a complete and valuable data set when 77 items need to be validated. Therefore, a 32-item ARSS (Acute Recovery & Stress Scale) Questionnaire and an 8-item SRSS Questionnaire were developed based on the RestQ Questionnaire. The 8 items of the SRSS correspond to the 32 items of the ARSS as descriptors in order to make the Questionnaires easier to use in daily practice (Kölling et al., 2019)).

Consequences of imbalance & preventions

A long-term imbalance between stress and recovery can lead to a state of overtraining (Lehmann et al., 1999), as shown in Figure 15. Therefore, continuous monitoring of stress and recovery in the training process is necessary (Hooper et al. 1999). In addition, a comprehensive assessment should be carried out on a regular basis, including training documentation, subjective and objective psychological and physiological data (e.g. lactate testing) and the athlete's perspective . Optimisation of an athlete's recovery process can be achieved by focusing sport research on psychological interventions, ideally in combination with physiological interventions (Kellmann, M.; Kallus, K.W. (2001)).

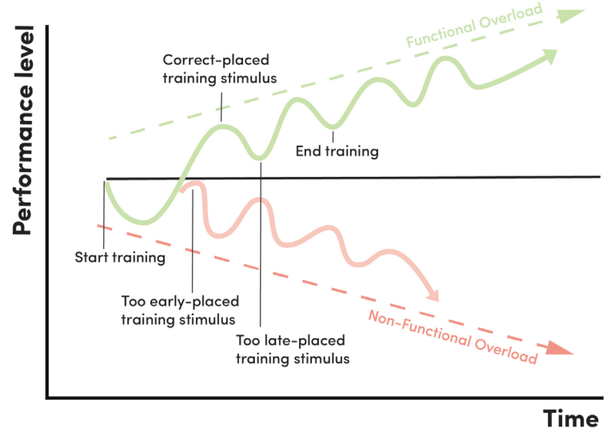


Figure 15: The influence of (im)balance of stress and recovery of training load

Dutch SRSS Questionnaire validation

The RestQ-sport Questionnaire has been validated in English. A study from the University of Groningen, investigated that the Dutch RestQ-sport has a reliability and validity similar to the original version, which supports the cross-cultural usefulness of the scale (Nederhof et al., 2008)). An AMS expert from NOC*NSF indicated that the validation of the Dutch translation of the SRSS Questionnaire is still in development.

As the SRSS has not yet been validated in the correct Dutch translation, and the use of the official SRSS Questionnaire means that no other questions or translations can be used, the KTTs use the name 'Wellness Questionnaire'. The reason for this is to make the Questionnaire from the literature practically understandable for Dutch athletes by providing Dutch paraphrases, and to be able to make minor adjustments to include questions about your 'period' for female athletes. AMS is used to assess an athlete's recovery-stress state in a digital Questionnaire and currently assesses five aspects to measure overall health status: Physical Readiness, Mental Readiness, Emotional State, Motivation and Soreness. Athletes and coaches have the most difficulty in interpreting and assessing the mental health aspect called 'Mental Readiness'.* Defined in the literature by Kellmann (2010) as attentive, receptive, mentally alert and concentrated.

**The last conclusion was based on findings in 4.2.2*

Key takeaways

- Optimisation of an athlete's recovery process can be achieved by focusing sport research on psychological interventions, ideally in combination with physiological interventions.
- Gibb's reflective cycle, which consists of six stages, helps to learn from experience by creating an action plan for each new cycle based on the lessons learned.
- A psychological model for the early detection of a crisis, in the case of this project overtraining, is called a 'signaling plan' and is therefore used in this Master's thesis as inspiration. The reflective capacity of the athlete and the next steps of the staff should be considered for an effective implementation of the model.
- The SRSS Questionnaire consists of 8 questions that measure the individual athlete's perceived state of recovery stress in order to predict and prevent overtraining. It takes less than a minute to complete and should be taken before the start of training.
- Literature is not always authoritative in practice. The SRSS is called the 'Wellness' Questionnaire in the KTTs in order to make the Questionnaire from the literature practically understandable for Dutch athletes by providing Dutch paraphrases, a 1-10 likert scale, and to be able to make minor adjustments to include questions about the menstrual cycle.
- Athletes and coaches have the most difficulty in interpreting and assessing the mental health aspect called 'Mental Readiness'.*

**The last conclusion was based on findings in 4.2.2*

2.2.3 Research on successes and failures of self-monitoring

This section answers sub-question number five about what kind of research is already being done on monitoring at Innovatielab by looking at the Innovatielab website and talking to employees from Innovatielab. In addition to looking at what's been done in other disciplines, the designer interviewed the project manager of the Sailing Innovation Centre and looked at further literature suggested by this interview.

5. What research has been already on monitoring and has it been applied in other sports disciplines?

Self-monitoring is nothing new in sports culture. However, the success or failure of getting their athletes to self-monitor is still a challenge for many sports federations. For this reason, a number of studies are discussed below that report on their successes and failures in increasing athlete compliance.

Increase compliance of self-monitoring

Content of research

In Bos, R., & Bekkering, A.'s (2019) research at the Water Sports Federation, they conducted a study to gain insight into why athletes don't consistently monitor their data and what would work to increase this compliance in self-monitoring. A Questionnaire was sent to 25 athletes with an average age of 25, who use SmartaBase to monitor their training load. They also conducted an exploratory study to determine the predictive value of monitoring variables for injury prevention.

The paper suggests the theories of Saw, et al, (2015 & 2016) to have a success in self-monitoring:

"The success of self-monitoring depends on the user's perspective. To influence this perspective & increase the use of self-monitoring, the purpose and importance of self-monitoring should be clear. This can be achieved through clarity in the completion procedures and should be built into the daily routine. Feedback from the coach also plays an important role, where both the athlete and the coach need to believe in the feedback."

Results of the study

Analysis of the data showed that the variables used in SmartaBase were not significant predictors of injury for the Water Sports Federation. This may have the effect of reducing awareness of the importance of monitoring among athletes and coaches. The results of the Questionnaire show that there is a high level of interest in SmartaBase. Forgetting to complete the Questionnaire, lack of relevant feedback, lack of motivation especially after training sessions and lack of clarity in the use of words in the Wellness Questionnaire are factors that often lead to data not being completed. As a suggestion to increase compliance through consistent monitoring, the coach in particular should take an active role:

- Clarification of terms and assistance in completing data and sending reminders are important aspects for a coach to consider.
- Explaining how the data is processed in SmartaBase, what values are derived from it and what these values mean for the correct interpretation by the athlete is important to increase trust in the athlete.
- Athletes want feedback from their coach or an expert when they are in training camp, when they have an injury or increased risk of injury, when their Wellness score drops or when their training load is higher or lower than planned.

Interview

In a personal interview, the expert in the paper emphasised that if you want to encourage self-monitoring, you need to emphasise its importance, use periodisation to be less consious about your top sport career every day, make it as easy as possible and try to encourage more training, as the tool is also designed to help with the positive part of monitoring your data. The expert also emphasised that athletes don't want to be aware of their health status every day, and this is one of the biggest barriers to do daily self-monitoring.

To conclude, the coach and team of experts should ensure clarity about the content of the data, send reminders to complete the Questionnaire and provide relevant feedback to the athletes. The proposed suggestions in the paper are wishes and requirements for the new design which will be developed in the next diamond.

Key take-aways

- The wishes and requirements for the design carried out in the Develop phase are partly based on the research by Bos, R., & Bekkering, A. (2019) to increase compliance in self-monitoring: In particular, the coach should take an active role. In addition, the coach and team of experts should ensure clarity regarding the content data, send reminders to complete the Questionnaire, and provide relevant feedback to the athletes.
- Speed skaters who matched the coach's training variables showed increased perceptions of success, physical recovery, self-regulation and personal achievement. However, those who don't match the training variables are at high risk of under- or overtraining. If the coach misinterprets the data from the Wellness or RPE Questionnaires, the risk of overtraining is high. Barriers may include the financial resources and time constraints of coaches in these groups.

Mismatch in training load between coach and athlete

The ability to measure an athlete's training load and recovery has become more measurable in recent years due to innovations in the world of sport. The simplest way to measure training load and recovery is through heart rate, or according to Kölling et al. (2019), it can be measured using the SRSS scale and the RPE (rate of perceived exertion) (Van Hooren, 2015)).

Mismatch in measuring training load

To quantify the training load in the rate of perceived exertion (RPE), both the athlete and the coach make their own assumption of how the training load is applied on a scale of 1 to 10. If both the athlete and the coach select a different value for training load, the RPE is not consistent. Research by Brink, M.S. et al, (2017) shows that there is often a mismatch in training load between coach and athlete, which can lead to suboptimal performance due to undertraining and overtraining (Roete A.J, et al (2021) & Otter R & BLitterswijk M van (2021). Furthermore, it is important that the coach does not determine the RPE score for an individual athlete, but for a subgroup within the team. However, there is a lack of qualitative research with coaches and athletes on the actual reasons for the observed mismatch, and Kerkhoff, M., et al (2022) launched a study to find out more.

Reasons for mismatch

According to Kerkhoff, M., et al (2022) the actual training load of an athlete often does not correspond to the training load designed by the coach. The article suggests the following reasons: "Common causes include misjudgement of the athlete's load capacity and difficulty in using the RPE scale". In addition to the difficulty of using the RPE scale or using the scale as a motivational tool, external factors (weather conditions, fatigue from previous training sessions, work and study commitments or social interactions with the team), variation in training duration, administrative reasons and differences in training duration are also mentioned. Training duration is defined as from warm-up to cool-down (Foster C, et al. (2001)), with athletes often including warm-up and ice-preparation breaks, whereas the coach only counts time.

Long-term issue

It is important for the coach to gain a better understanding of the (internal) training load of his athletes. Speed skaters who match the coach's training variables have shown increased perceptions of success, physical recovery, self-regulation and personal achievement (Otter, R. T., et al. (2022)). However, those who don't match the training variables are at high risk of under- or overtraining. This correlates with the Wellness Questionnaire. If the coach also misinterprets the data from this Questionnaire, the risk of overtraining is also high. Barriers may include the financial resources and time constraints of coaches in these groups (Van Loon, J. (2021)) or as described by Foster C, et al (2001): A potential cause of the overtraining syndrome may be unrecognised errors in the execution of the training programme by the athletes.

2.2.4. Reflection on sport progression by the target group

This section explains the interview sessions with the athletes, coaches and embedded scientists and is based on the information gathered from the literature review, observations and expert interviews in the previous sections of this chapter. The goal of the interviews, the method, the experimental design, the results and the conclusions are explained in the following section. It is important to note that these interviews were conducted in the 2023/2024 season, which means that the athletes worked with the SmartaBase monitoring tool instead of Teamworks AMS.

Interview questions
In order to increase the user engagement for AMS by junior athletes and their coaches as stated in the aim of research approach in 2.1.1, the interview questions are focused on:

- "How athletes reflect on their sport progression and give feedback to the team of experts?"

&

- "How the team of experts (in this case coaches & embedded scientists) reflect on the sport progression of a team of athletes and link that back to athletes?"

The interview question is divided into sub-questions, found in Appendix X, that capture 5 different categories (Who, Data, Tools, Feedback & Moment of Reflection) in the now and ideal situation to find the most promising design areas for increasing user engagement.

Method
Context mapping is an interview technique used in the sessions and is based on the research by Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005) to map the interaction of the target group in relation to sport progression within the 5 categories in order to create a new design that fits into the lives of the target group who will use it. Using this technique will gain a deeper insight into the needs and wishes of the target group of the new design.

Test Set-up

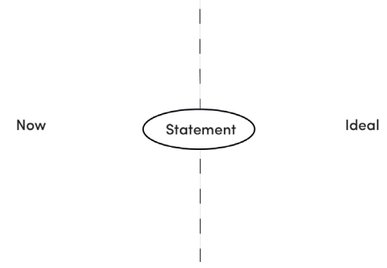


Figure 16: Template interviews

A sheet of paper was used, divided into two parts, with the 'now situation' on the left and the 'ideal future situation' on the right, and the interview question written in the middle of the dividing line, as shown in Figure 16. The ideal situation can be explained, for example, by the category 'who': who the athlete will need later in his career as a top athlete, or who is still missing.

Next to the sheet of paper are different types of icons divided into five categories. The categories and icons guide the participants in what is important to them when answering the interview question. The participant can select an icon and place it in the preferred location on the sheet of paper. For each category there are additional questions that can be asked during the interview when selecting an icon from a category, which can be found in Appendix B.

For the interview with the embedded scientist, the five categories are narrowed down to three (tools, data & feedback). These are the most important categories when analysing athletes' data.

Participants and photos of test set-up
The interviews were conducted by a total of four junior and two senior athletes, two coaches and one embedded scientist recruited from different KTTs with a mix of males and females. A time limit of 15 minutes was set for each interview. A mixture of offline and online interviews were conducted, and the set-up of these tests is shown in Figure 17.

Figure 17: Offline and online interview set-up of athletes & coaches

Pivots on test set-up and influence on results
Several iteration steps were performed on the test setup. These included:

- Changing the interview question to a more personal phrasing (athlete → you).
- Adding a now and ideal situation to capture needs and wishes.
- Reducing the categories to a maximum of five and reducing the icons to avoid overwhelming information.
- Adding an icebreaker and highlighting the goal of the session in the introduction to make clear why this session was important to them.
- Adding words under the icons for quicker recognition.

After three interview sessions with athletes a major change was made to the interview question as three out of three athletes mentioned that they missed feedback from the coach in the SmartaBase monitoring system and had the feeling that the staff didn't look at their data. Therefore, in the other remaining interviews the focus was on how athletes receive or send feedback to the team and whether the coach plays an important role in this process of processing feedback from the athlete.

Pivots are also made inbetween interview sessions, so some of the pictures shown in this section were taken before some pivots of the session. The influence on the difference in results will be limited. The pivots made are mostly done with the students beforehand. In addition, important needs and wishes evolved automatically from the interviews, by being attentive and asking through when they mentioned them.

Social network of athletes to analyse sport progression in & outside the KTT

Results
In the following section, the results of the interview sessions are presented by clustering the statements & icons that answered the interview question. The results of the interview toolkits can be seen in Figure 18 and are presented in more detail in Appendix C. This section is followed by a section on how this clustering process was carried out and how potential design directions emerged from this clustering process.

Figure 18: Results of interview toolkits of athletes, coaches & embedded scientist

Insights of analysing the icons & statements

Each of the five categories has a set of icons. These icons are analysed in terms of the number of times they are mentioned and where they are placed on the paper in relation to the current and ideal situation. Furthermore, these icons are supported by statements from the target group with an explanation of the chosen icon. The conclusions drawn from these results are presented below.

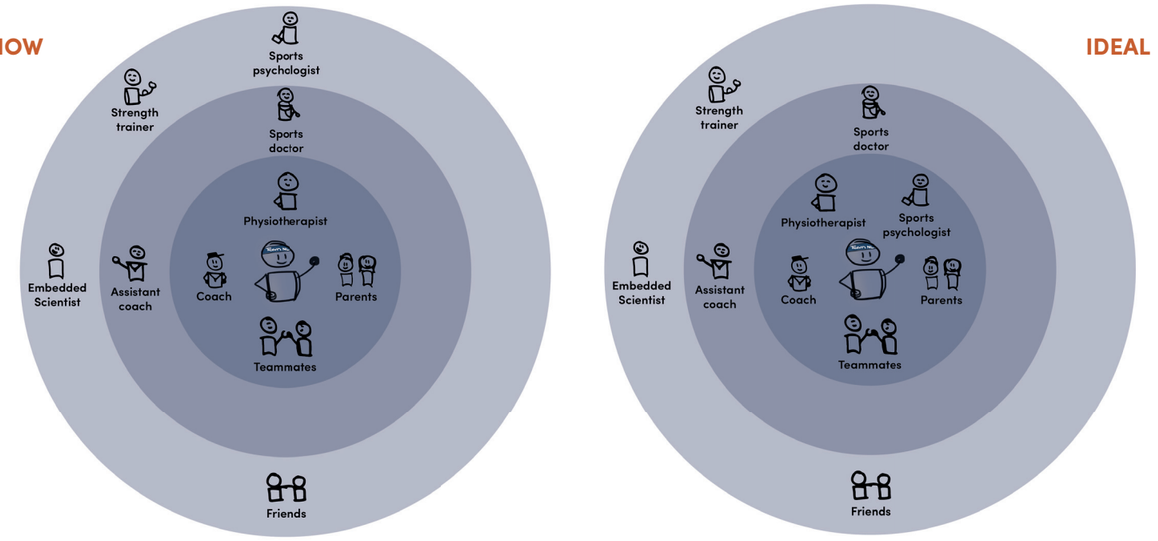


Figure 19: Social network to analyse sports progression of athletes in the Now & Ideal future situation in & outside the KTT

The analysis of the athlete's progress can't be done by the athlete alone. That is why the social network of an athlete's team of experts is mapped out, which the athlete needs when reflecting on his sport's progression in the Now & Ideal situation, as can be seen in Figure 19.

Three circles can be distinguished in the figure, the inner circle representing the people the athlete thinks he needs most, and the outer circle representing the people he thinks he needs less often in his reflection process. The inner circle was mentioned by four out of six athletes, followed by three out of six and the outer circle by two out of six.

Five out of six athletes mentioned that they thought they would need a sports psychologist in the future situation. Some mentioned a regular check-up every month.

Quote 1*

**Due to AVG rules, quotations are placed in the confidential appendix.*

Key take-away

- The sports psychologist will have an important role to play in the future in reflecting on the athlete's progress.
- The social interaction between the athlete and people in the inner circle is important for the athlete's beliefs and perceptions when reflecting on their sports development:
- the coach influences the athlete's motivation to use the monitoring system
- teammates are needed to grow in the sport but are also competitors;
- parents play an important role when it comes to their mental state.
- Embedded scientists are the drivers of the monitoring systems, but they aren't seen by the athletes as someone they directly need to reflect on their sports development.

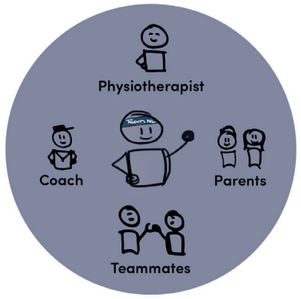


Figure 20: The inner circle of an athlete's social network, which influences motivation and helps the most to reflect on sporting progress.

The social interaction between the athlete and people in the inner circle is important for the athlete's beliefs and perceptions when reflecting on their sports development, see Figure 20 for an illustration of the inner circle. The coach influences the athlete's motivation to use the monitoring systems. Three out of four young athletes said that they had the feeling that the staff didn't look at their data in AMS.

Quote 2

Another quote highlighted the importance of teammates to grow in sport performance.

Quote 3

Parents also play an important role for athletes, especially when it comes to their mental state. An embedded scientist is the driving force behind the monitoring systems, but is not mentioned in the inner circle. Athletes don't see the embedded scientist as a person they need directly for their reflection.

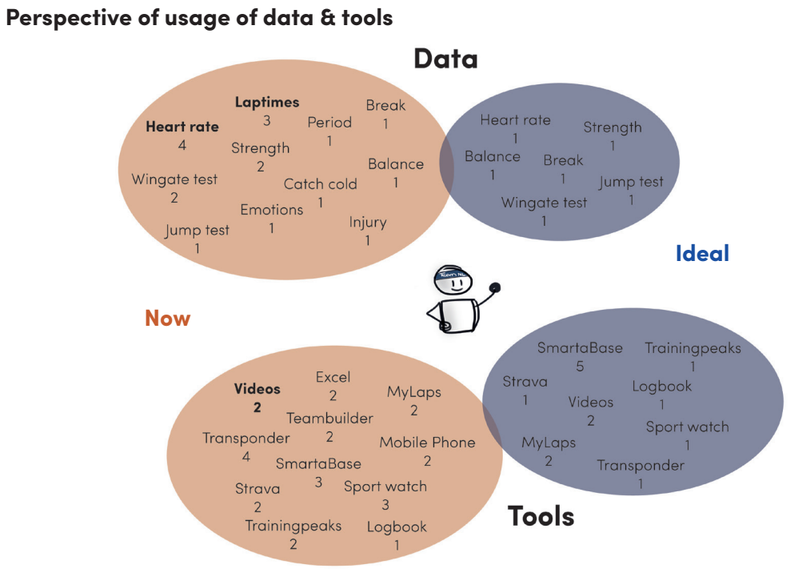


Figure 21: Results interview perspective on data and tools of athletes

The analysis of sport progression is done through several monitoring tools, as can be seen in section 2.2.1. All of these monitoring tools collect a lot of data, and in the interview we explored what was most important to athletes in terms of tools and data when reflecting on their sport progression. Results are clustered in Figure 21.

Data

Heart rate is mentioned by six out of six as an important data measurement but can be stressful, and four out of six agreed that videos and lap times are the most important data to look at regularly. Jump and Wingate tests are done at periodic moments throughout the year, but give an idea of your progression and shape over time, and it takes some time to get to know the limits of your body.

Quote 3

The icons selected by athletes for sport progression tend to focus on objective measures. The subjective measures may be difficult to measure or may vary from day to day, and the coach, due to a lack of background knowledge, focuses mainly on objective data.

Tools

Many monitoring tools are used by athletes due to the strengths of each application. Therefore, more harmony between the applications is preferred, but this is beyond the scope of the project due to technical issues. The monitoring tools can be used to communicate to the coach on giving a sign how fit you are for the training.

Quote 5 & 6

Key take-away

- The most important data for athletes, which is mostly objective data, is heart rate, videos and lap time. Subjective data, such as mental data, is difficult to measure because it varies from day to day, or because a coach does not have the background knowledge to help athletes with it. It takes time to get to know your body and reflect on your mental and physical state.
- Monitoring tools can be a way of communication between the athlete and the coach, to give signs of how the athlete can succeed in training. In other words to say if they are ready or not and to make it easier to give signs that it's OK if today doesn't go as planned.
- There is a lack of harmony between the monitoring systems used by athletes. But this is outside the scope of my project as it is more of a technical issue.

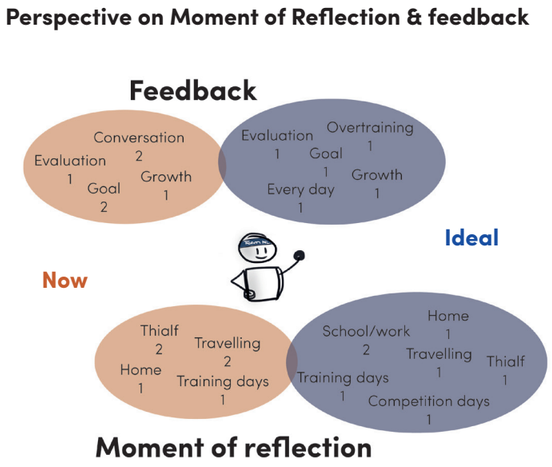


Figure 22: Results interview perspective on feedback and moment of reflection of athletes

Analysing sport progress and implementing the results in training can be done by giving the right feedback when athletes are open to suggestions about the results. In the interview we looked at what is important to athletes when they receive feedback and suggestions in terms of the moment of reflection and feedback. Results are clusterd in Figure 22.

Feedback

The way feedback is given now is not preferred as athletes want to see more of what coaches and staff do with the results. There is little feedback on what is being done with the monitoring systems during the season and training programmes feels generic and athletes want more individual customisation.

There is also a difference in responses between junior and senior athletes. Three out of four junior athletes said they felt the coach didn't look at the data from the SmartaBase monitoring tool. On the other hand, two out of two senior athletes saw the benefit of using the SmartaBase application as a means of communication, but are not motivated if the coach doesn't take an active role in motivating them.

Quote 7 & 8

Key takeaway

- Athletes experience a lack of personalisation of training when logging due to limited staff time. Therefore, a new shift in feedback during the season is needed as athletes want to see more of what coaches and staff are doing with the results of the data athletes provide through monitoring tools.
- Top sport athletes don't want to be aware of their top sport career every day, as this involves a lot of stress and pressure of being a top athlete. A different way, e.g. periodisation, should be considered to reflect on your health status.
- Correct communication of data interpretation between athletes and coaches is important in monitoring tools to avoid misinterpretation of data and the risk of under- or over-training.
- Athletes prefer to log good Wellness scores because they do not want to be restricted in their training. This sometimes leads to them not logging honestly and not contacting support staff for help.
- Check-in time varies from athlete to athlete

Moment of reflection

Variety is important to balance school and sport, not being conscious of your top sport career every day to get less stress and pressure that comes with being a top athlete. This could be one of the main reasons why in the study by Kerkhoff, M., Stoter, I., & Otter, R. (2022) 7 out of 9 athletes don't fill in their Wellness Questionnaire regularly. In the study of Bos, R., & Bekkering, A. (2019) it was suggested to implement periodisation to reflect on your health status or other ways to reflect on your health status should be considered.

Quote 9 & 10

In addition, the coach's communication of the correct interpretation of the data is not always accurate and can make athletes feel insecure. Athletes also mentioned that the scale doesn't always match the way they interpret it. This can lead to a high risk of undertraining or overtraining according to Foster C, et al (2001) in 2.2.3.

Quote 11

Self-reports of overtraining or pressure from external factors such as school are difficult for athletes to communicate to coaches because they are very committed to their sport and don't want to train less. Young athletes create a lot of their own pressure to prove themselves. It is a balance of how honest they are with their coach and themselves.

Also, the moment of check-in is different for each athlete, some prefer more 1:1 moments initiated by the coaches, while others go to the coach themselves. The time and place for reflection is inconsistent for an athlete and therefore easy to forget, even if they want to keep track.

Coach & Embedded scientist
Results

Team of experts for coaches to analyse sport progression of athletes

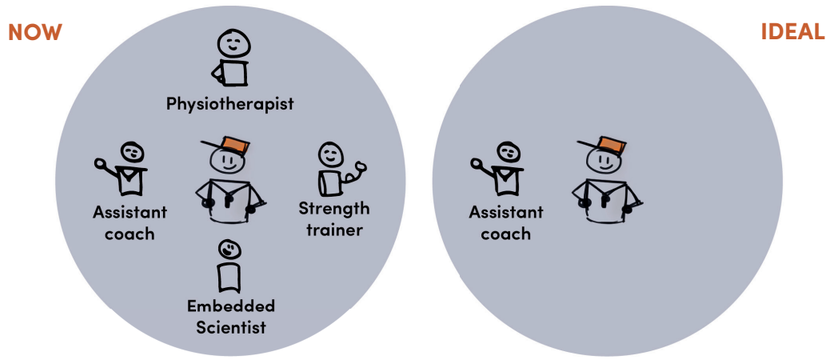


Figure 23: Team of experts for coaches to analyse sport progression in the Now & Ideal situation

The analysis of the athlete's progress can't be done by a coach alone, so the coach's team of experts is mapped on Who is important when reflecting on the athlete's progress in the Now & Ideal future scenario, as can be seen in Figure 23.

A coach and assistant coach work closely together with the embedded scientist to reflect on the athletes' data. In an ideal situation for KTTs, the coaches should want to share the workload of analysing athletes' data among more team members (e.g. assistant coaches), as KTTs have one or two coaches looking after an average of 15-20 athletes.

Barriers

A barrier experienced by coaches is the lack of time and human resources. In addition, assistant coaches work on a voluntary basis and KTTs have less knowledge about monitoring systems compared to top national teams.

Another barrier is coaches' prior education and background knowledge, which influences how coaches analyse data or work with monitoring systems. Some coaches are more data-driven than others, or some believe in the same type of training that has been used for years. Background knowledge also influences how coaches perceive physical and mental data, e.g. one coach mentioned that he felt more comfortable analysing physical data than mental data.

Quote 12 & 13

Key take-away

Barriers experienced by KTT coaches are ...

- ... limited time and resources in terms of manpower, assistant coaches are mostly volunteers and monitoring tools in comparison to the top national teams.
- ... prior knowledge and background in monitoring systems. This influences how they analyse and perceive physical and mental data and how much they understand about monitoring systems.

Perspective of usage of Tools, Data & Feedback

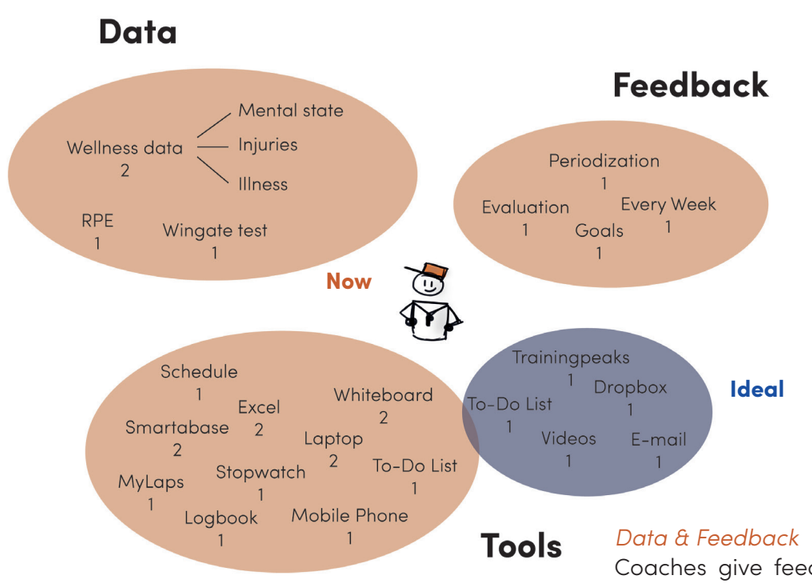


Figure 24: Results interview perspective on tools, data and feedback of coaches

The analysis of sport development is carried out using a variety of monitoring tools. The interview covers the analysis of data, the tools used and the way in which coaches give feedback to athletes. The moment of reflection is not addressed in the interviews due to time constraints. Results are clusterd in Figure 24.

Tools

SmartaBase has only been used in the KTTs since 2022. KTTs are still learning and discovering the potential of the application. Other monitoring tools, such as Trainingpeaks, offer more functionality to analyse objective data. Therefore, SmartaBase can't compete with this monitoring system, but it should be explored how the needs of a coach in terms of functionalities to analyse athletes' data can also be better harmonised between monitoring systems. In addition, a monitoring platform for coaches should be easy to find and use, otherwise coaches will stick to what they are used to.

Quote 14

Data & Feedback

Coaches give feedback when they see something unusual and focus on things that aren't going well. They also compare the group of athletes rather than looking at individual athletes because of time constraints. As a result, training programmes are generalised and small adjustments are made for athletes. Variable attendance and inconsistent data input from athletes also make it difficult for coaches to provide relevant feedback.

The lack of knowledge mentioned in the Who section influences the way coaches look at data and their next steps when analysing physical and mental data. Physical data is something coaches are used to and easier to act on directly than mental data.

Quote 15

Key take-away

- The way a coach analyses data and gives personal feedback is influenced by the varying presence of athletes & the limited staff of a KTT. They have a lot of work to do and as a result they are taking action on negative data due to time constraints.
- SmartaBase is new to the 2022 teams and is not at the same level of physical data analysis as Trainingpeaks. More support is needed to convince a coach to switch from one monitoring platform to another, as it takes time to learn a new platform.

Perspective of usage of tools, data & feedback: Embedded scientists

The analysis of the athlete's progress is carried out using a number of monitoring tools. The embedded scientists support the coaches by providing feedback on the data collected by the monitoring tools.

Role of an embedded scientist

The role of the embedded scientist is to analyse the data, provide an overview and feedback on short and long term progress. The embedded scientist is the bridge between the coach and the athlete to make the data understandable and directly applicable to the speed skating season. That's why the team trusts the embedded scientist to analyse everything they think is important.

Quote 16

Choice of monitoring tool

The reason why KTTs and embedded scientists suggest using SmartaBase is for security, unity (one system with all information) and the support provided by the NOC*NSF.

Barrier in providing feedback on data and tools

There is a lot of data being collected and therefore limited time to analyse it and provide enough expertise to support coaches in the results of all the data analysis being collected and how to work with the monitoring platforms. In addition, the communication of data results to athletes is initiated by the embedded scientists themselves, rather than stimulated by the coach. Coaches don't see their influence in the role of motivator among athletes (see Who by Athletes section) for the use of monitoring tools. This ultimately leads to the next barrier, which is the inaccuracy of the data set due to irregular data entry by athletes, which leads to the risk of drawing false conclusions.

Effective data analysis is now focused on short-term implementation to provide relevant input into the mental and physical condition of athletes. The ambition of the scientists is to extend this to long-term analysis.

Key take-away

- The reason why KTTs and Embedded Scientists suggest using SmartaBase is because of the security, unity and support provided by the NOC*NSF.
- The Embedded Scientist analyses the data as effectively as possible to advise the coach and is the bridge between coach and athlete to make the data understandable, practical and directly implementable, therefore the trust in the Embedded Scientist is high in the KTTs.
- Sharing summaries and results is outsourced to the Embedded Scientist and therefore the role as motivator for athletes is not clear to coaches, which influences data input from athletes and the irregularity of data input from athletes leads to a high risk of drawing wrong conclusions from the data.
- A lot of data is collected and therefore there is limited time to analyse and provide enough expertise to support coaches in data analysis and how to work with monitoring tools.

Clustering statements into design directions

Statements from the interviews are clustered into one of five categories: Who, Tools, Data, Feedback, Moment of Reflection (and others for those statements that don't fall directly into a category). These statements are again clustered on the basis of overlapping statements within the category, as can be seen in Figure 25 or in Appendix D.

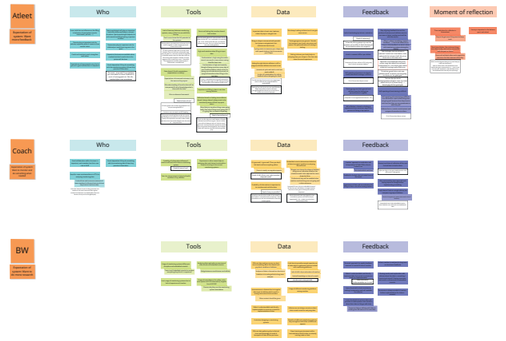


Figure 25: Clustering of statements in categories of who, tools, data, feedback and moment of reflection.

These statements are again clustered based on overlapping themes and most interesting design space opportunities, as can be seen in Figure 26. These results are opportunities to derive several design directions to explore the design space and ultimately a design goal, which will be explained in the next chapter.

Conclusion of interviews

At the beginning of this chapter we stated the following aim: "How can we involve athletes more in the monitoring system of their own development as elite athletes? By interviewing athletes and their team of experts (coaches & embedded scientists) using the context-mapping method, and by clustering the statements from the interviews into five categories, we obtained results on several themes on how we can involve the athlete more in the monitoring systems of his own development. From these results we will derive design directions, which will be explained in the next chapter, in order to obtain a design goal.

Opportunities

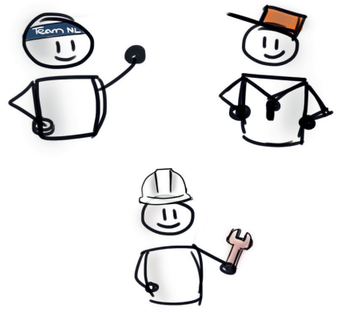
Clustered by theme

Monitoring system

- Use the strength of each monitoring platform in functionality used by athletes for analysing data by coaches as extra recourse besides own capabilities & create more coherence between those strengths
- Stimulate the athletes with the appropriate motivation & show appreciation for filling in SRSS & RPE forms
- Acceptance of confrontation or make the confrontation less present when athletes are analysing their health status
- Lower the threshold for athletes to be able to analyse their data at the right moment to see how the load is applied and talk to experts when needed
- Make self-reporting of stimulation of extra training or reporting overtraining/pressure of external resources easier for athletes to coaches so professional help is used when needed
- Make consequences less impactful when filling in tests (it's okay to not to be okay). Stimulate more training instead of less training.

Communication between athlete & coach

- Athletes want to have more confirmation & involvement in the results of what the staff does with the information they are given in the forms to make relevance clear to athlete to check-in using the platforms
- Discuss with athletes how the SRSS & RPE test should be used & how data analysis work by coaches & talk with athletes if data is mismatching/inconsistent



Coach expertise

- Get support in how to use monitoring systems & analyse data as easy as possible
  - Support in interpretation of data
  - Support in efficient data analysis

Role of embedded scientist

- Get support of providing enough expertise to coaches & athletes of data collected by monitoring systems

Figure 26: Opportunities clustered by overlapping themes and promising design spaces.

2.3. Key findings of the Discover phase

A summary in this section will give us an overview of all the insights gained in 2.2. of the key findings that we should keep in mind for the upcoming chapter 3. These key findings are linked to what is needed for the project aim. The findings can be divided into literature and interviews findings.

Key findings Literature research
(2.2.1., 2.2.2., 2.2.3.)

- High risks of under- or overtraining are caused by misinterpretation of health data by coaches or speedskater who don't match the coach's training variables. Barriers may include the financial resources and time constraints of coaches in KTTs. Based on 2.2.3.
- A psychological model, called a 'signaling plan', can be used as inspiration in this project for an early detection of a 'crisis', or in this case 'overtraining syndrome'. Based on 2.2.2.
- The reflective capability of an athlete and the next steps of the staff should be be considered for an effective implementation of the model. *
- Sport psychologists states athlete's capacity of self-reflection is crucial in data logging. *
- To increase compliance in self-monitoring the coach in particular should take an active role in motivating the athletes to use monitoring systems. In addition, the staff should ensure clarity regarding the content data, send reminders to complete the Questionnaire, and provide relevant feedback to the athletes. Based on 2.2.3.

Key finding expert interviews
(2.2.4.)

Athletes

- The inner circle in an athlete's social network is important for the athlete's beliefs and perceptions when reflecting on their sport development.
- A coach influences the athlete's motivation to use a monitoring system
- Athletes prefer to log good Wellness scores because they do not want to be restricted in their training. This sometimes leads to dishonesty in logging and not contacting support staff for help.
- Athletes find it difficult to complete health Questionnaires.
- They do not understand the questions or interpret them differently. Mental Readiness is the most difficult question to answer. *
- They find it confronting to be aware of their health status on a daily basis.
- They experience limited feedback or personalisation based on their logging data. They feel that the results are not being looked at.
- They start to doubt themselves due to misinterpretation by the coach.
- They want to see what staff do with the information and interpretation of the data they provide.

Coach

- Barriers experienced by KTT coaches are pre-education and background knowledge. This influences how they analyse and perceive health data and their understanding of monitoring systems.
- Sharing overviews and results of data findings is outsourced to the embedded scientist and therefore the role as motivator for athletes is not clear to coaches, which influences data input from athletes and the irregularity of data input from athletes leads to a high risk of drawing incorrect conclusions from the data.

Coach and athlete

- Monitoring tools can be used as a way of communication between the athlete and the coach. For example, the athlete can give an indication of how his or her health will affect the completion of training and make it easier to say that today didn't go as planned.
- Proper communication of data interpretation between athletes and coaches is important in monitoring tools to avoid mismatched data and the risk of under- or over-training.
- The way in which a coach analyses data and provides personal feedback is influenced by the varying presence of athletes and the limited time or staff in KTTs. As a result, action is taken when negative health data is received.
- Athletes and coaches have the most difficulty in interpreting and assessing the mental health aspect called 'Mental Readiness'.*

Embedded scientist

- Embedded scientists are limited in the time they can spend with each coach/athlete, but try to make the data as practical as possible for coaches.
- Deep analysis of overtraining based on embedded scientist data is difficult due to infrequent data collection by athletes

Monitoring tools

- The reason why KTTs and Embedded Scientists suggest using SmartaBase is because of the security, unity and support provided by the NOC*NSF.
- SmartaBase has been used in the KTTs since 2022. The KTTs are still learning and discovering the potential of the application.
- Other monitoring tools work better for certain aspects

**The last conclusion was based on findings in 4.2.2.*

3. Define

This chapter introduces the second part of the first diamond, the 'Define' phase. According to the Design Council (n.d.), the definition of this phase should help to define the challenge differently from the insights gained in the Discover phase.

The opportunities from the results of 2.2.4 are converted into design directions to explore the design space and ranked in a C-Box in 3.1 (Van Boeijen, et. al. (2020)) to determine which opportunity has the most impact and is viable to achieve the project aim. In 3.2 the selected design opportunity is translated into a design goal. An analogy of an interaction vision is used as an additional requirement for the final design in 3.3. The requirements of the interaction vision and other requirements and wishes based on the results of Chapter 2 are listed in 3.4.

3.1 Design Directions

The opportunities from 2.2.4 are validated on a C-box (Van Boeijen, et. al. (2020)) with 'Impact' on the x-axis and 'Viability' on the y-axis. One design direction is selected from this C-box validation to start the next section with the translation of this design direction into a design goal.

Design directions

To explore the design space and the possibilities from each of the opportunities listed in 2.2.4, new design directions are formulated for each opportunity, as can be seen in Figure 27. Attempting to derive one single design goal from all these design directions resulted in a design goal that was not viable to explore in the next chapter, as it was too large to start a concrete process.

C-Box validation

Therefore, a C-Box validation was applied to rank all opportunities on a scale of impact and viability to focus on which opportunity is possible within the timeframe of this project and has the most impact on the project aim stated in 1.3.1 (Van Boeijen, et. al. (2020)). Opportunities are given a number. These numbers are placed on a C-box with 'Impact' on the x-axis and 'Viability' on the y-axis, as shown in Figure 28 and the numerical ranking can be found in Appendix E.

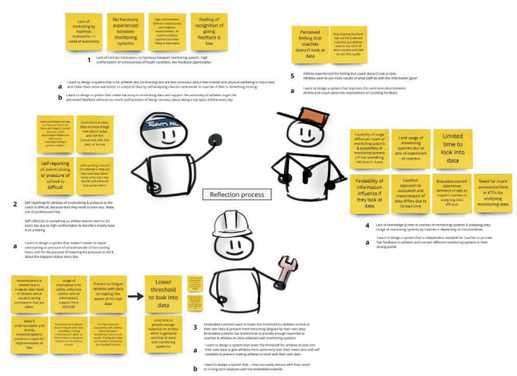


Figure 27: Design directions translated from the opportunities of 2.2.4

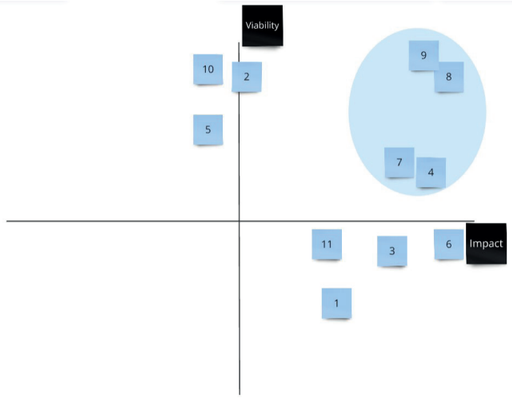


Figure 28: A C-box validation with 'Impact' on the x-axis and 'Viability' on the y-axis.

Selected opportunity
The low viability or low impact opportunities are placed in the top left or bottom right corner of Figure X. These opportunities are challenges that are technical issues or external factors that are out of reach, such as the way coaches plan their training programs and their attitudes towards monitoring systems.

The opportunities with high viability or impact are placed in the top right corner of Figure X. Numbers 8 and 9 are rated the highest and focus on improving communication between athletes and their coaches about the AMS monitoring system. In addition, numbers 4 and 7 are closely and focus on the change in behavior of athletes and coaches towards the AMS application. Improving communication and behavior around the Athlete Management System are related. Changing communication in the short term will ultimately change behavior in the long term.

In recent years, NOC*NSF research projects have focused on communication between coaches and embedded scientists, e.g. the coach-in-control project in 1.1.2, see Figure 29. Therefore, the design goal in the next section is based on the combination of both design directions, number 8 and 9, focusing on short-term implementation, and number 4 and 7 for long-term implementation, to improve communication between athletes and coaches.

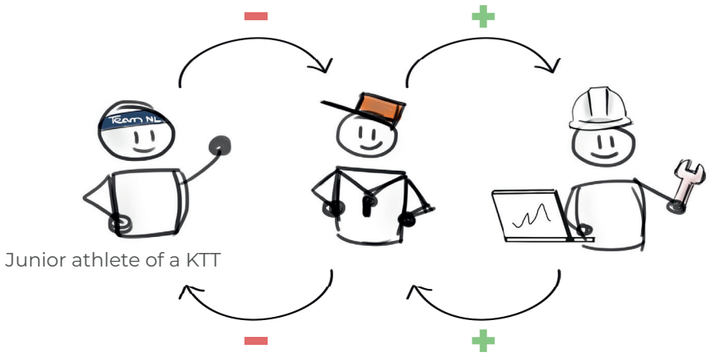


*Figure 29: Focus of communication in recent research projects of NOC*NSF*

3.2 Design Goal

This section states the design goal, which is derived from the combination of design directions that has the most impact and is viable and should provide direction in the next chapter for proposing a new design:

*The design goal is to design a tool that will **improve communication** and give more **guidance** between talented athletes of the KNSB, aged between 16-22, and their coaches...*

*...in **an explorative way** on how athletes **perceive information & confirmation** how and why the athlete management system is used...*

*...when **reflecting** regularly on the **mental health status** of athletes which can be confronting and therefore make it more discussable and normalized in the long run.*

Achieving this design goal will lead to increased user engagement with the AMS and will lead to the achievement of the overarching design goal of preventing overtraining and injury as stated in the project aim in 1.3.1.

3.3 Interaction Vision

Interaction Vision
Designing a novel tool will create new interactions and experiences when participants use the final design. These interactions can be designed. As a design method, an interaction vision is needed, which is an analogy of how the proposed product should interact and be experienced by the user (Pasman, et al., (2011)).

Figure 30: Analogy of the Interaction Vision

Interacting with the design should feel like ...

*... learning a new hobby, such as photography, where you keep practicing, learning, and reflecting on what went well and what went wrong. After a year, you will be more comfortable with the camera and know what settings work in different environments.**

**Illlustrated in Figure 30*

3.3.1 Interaction Qualities

This interaction vision has interaction qualities that serve as product qualities and requirements for the new proposed design.

Qualities: Guidance, explorative and challenging

Properties:
Guidance
- Several sessions of becoming familiar with the process to be better able to reflect on it.
- Practicing together and alone, having a reference of how others do the task who may be more experienced and have done it before.

Explorative:
- In terms of tools, to allow the user to choose what suits them in cameras and attributes
- as easy as possible to start to make a new photo
- pick up whenever the user feels the need to make a photo

Challenging:
- To provide help during the session if the user doesn't know where to start or needs help on the first try.
- Explore the possibilities of functionalities of the settings of the camera

3.4 Requirements & Wishes

Listing the requirements and wishes for the new design gives a clear understanding of the functionalities of the design. This list is based on Chapter 2 of the Discover phase and will be used as criteria for decision-making.

3.4.1 List of Requirements

Coach (Based on 2.2.3)
- The coach must take an active role in the requirements below to encourage self-monitoring and motivation in the athletes.
- Send reminders before and after training
- Provide valuable feedback from the data collected in AMS

Staff (Based on 2.2.2)
- Provide guidance on how to grow in reflective capacity as an athlete
- Take the correct next steps on what to do with the data received from the AMS application.

Introduction of the design (Based on 2.2.3 & 2.2.4)
- Explain the relevance of why monitoring is beneficial to the target group in a practical way.
- Explain that the results will be compared on an individual basis.
- Emphasise as an additional resource to staff skills

Design should be
.. based on the analogy of chapter 3.3
- clear in the instructions what is expected from the target group
- as easy as possible to get started
- easy to carry and pick up whenever the user feel the need
- used for several sessions to get used to reflection
- practiced with an expert and alone
- explorative in terms of tools, allowing the user to choose what suits them
- challenging to explore the possibilities of the design
- helpful if the challenge is to hard

*.. regarding the requirements of NOC*NSF (Based on 2.2.2)*
- corresponding to the scale from 1 to 10
- using the words validated in the English SRSS Questionnaire

3.4.2 List of Wishes

Design should help in the long run..
.. improve the athlete's ability to reflect and normalise the stigma of always giving their best as an athlete, making it easier to seek help and encouraging more training. (Based on 2.2.2, 2.2.3, and 2.2.4)

.. to be clear about what the staff's actions will be on data received from the Questionnaire (Based on 2.2.2)

.. encourage athletes to consistently track their health status in the AMS (based on 2.2.4)

.. to be in line with the Digitalisation program of NOC*NSF (Voortgang Programma Digitalisering Topsport - NOCNSF, (z.d.)) (Based on 1.1.2)

Key takeaways
The design goal in 3.2 will be the starting point for the next diamond phase to start the design process. The interaction vision in 3.3 will give an understanding of how the interaction between design and user should feel and will give a first start to the requirements listed in 3.4. The wishes and requirements are resulted from the insights from the research in chapter 2.

4. Develop

This chapter introduces the second diamond, which focuses on developing a design based on the research gathered in the first diamond. This diamond encourages finding different and finally, a suitable solution for the defined design space, seeking inspiration and co-designing with a range of different experts (Design Council (n.d.)).

In 4.1, the idea generation and selection process is carried out by using brainstorming sessions to generate ideas, clustering these ideas into concept directions, and evaluating these concepts to select one. This concept is developed and evaluated with experts in 4.2. Final improvements are made in 4.3. to finalize the design for the next phase.

4.1 Idea Generation & Selection Process

In this section, we start with a brainstorming session in 4.1.1 to generate many different ideas and solutions for the stated design goal using How-Tos (Van Boeijen, A. et al. (2014)). In 4.1.2, the How-Tos ideas are evaluated using the Hits & Dots method to identify elements that are promising regarding the stated design space (Heijne & Van Der Meer, 2019). These elements are combined into two concepts and Lo-Fi prototypes are generated. In 4.1.3. the two concepts are evaluated by a Harris profile (Van Boeijen, A. et al, (2020)) to select one concept for further development in 4.2.

4.1.1 Idea Directions

Goal
The goal of this section is to generate as many ideas as possible for the given design objective. A detailed plan of the test set-up and the results of the brainstorming session can be found in Appendix F.

Method
This brainstorming activity was conducted using the technique of How-Tos (Van Boeijen, A. et al. (2014)). Examples of How-Tos in the session are 'How to give information about how and why a platform is used' or 'How to measure your health'. Participants have to draw as many ideas as possible on 'How to' answer this question.

Set-up
The participants were one IDE student and two alumni of the IDE faculty, women aged between 20 and 30 years, and the session lasted two hours.

Through a scenario, participants were introduced to the context of a top sports athlete. Throughout the scenario, different How-To statements were addressed. The participant could respond to the How-Tos by using a Post-it note and pen, writing down ideas, and placing them on a blank piece of paper with the How-Tos statement in the center of the paper. The paper was placed in the middle of the table with the participants around it, as shown in Figure 31.

Figure 31: Brainstorming session with participants using Post-it notes to write down ideas

Results
At the end of the session, by reviewing the design goal and the ideas generated by the How-Tos, the participants concluded that it's important to stimulate relevant feedback to the athletes by clarifying the next actions of the coaches and to make the consequences of these actions less negative interpreted by the athletes to stimulate more training. The results of the How-Tos can be seen in Figure 32 and Appendix G.

Figure 32: Result of the brainstorming session

Individual brainstorming session and clustering results
One day later, an individual brainstorming session was conducted by the designer to iterate and explore the ideas generated in the brainstorming session with the IDE students. The How-Tos method is used for this individual brainstorming session. The next section explains how the results of the ideas from both brainstorming sessions are clustered into two concept ideas.

4.1.2 Clustering Ideas into Two Concepts

The results of 4.1.1. are clustered using the Hits & dots method (Heijne & Van Der Meer, 2019)). This is done by reviewing all ideas and placing a sticker next to the idea if it has the potential to solve the design goal. The dots are clustered and two concepts are developed, as shown in Figures 33 and 34.

Concept 1: Create a roadmap with information on why and how to use AMS as a conversation starter.

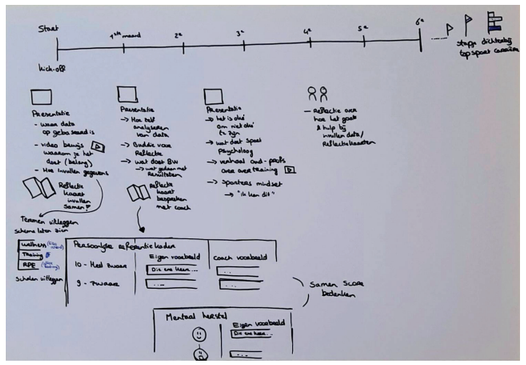


Figure 33: Concept 1 for improving communication between coach and athlete

Concept 1 focuses on improving communication between coach and athlete by providing a roadmap with more information on why and how Teamworks AMS is used through presentations and workshops including toolkits during a full speedskating season of an athlete. Toolkits are a powerful design method as they stimulate the 'IKEA effect' as a cognitive bias. Participants place a high value on products they have helped to create (Norton et al., 2011).

Concept 2: Create a new check-in hall to assess mental health status

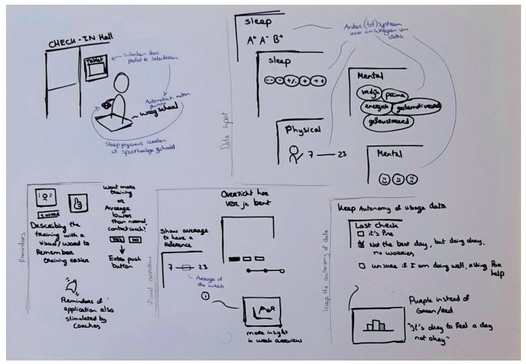


Figure 34: Concept 2 for improving communication between coach and athlete

Concept 2 focuses on improving communication between coach and athlete by providing a new way to check in on your mental health status. A check-in station is created to automatically measure information such as heart rate and weight, and a tablet with the AMS application is placed in this station. The AMS application has a new layout where you can choose different scales to assess your mental health status, making it easier to reflect on what is appropriate for the athlete that day. There is also an option to give the coach an indication of how to read the data. For example, "It's not my best day, but I am doing well" to make it easier to seek help.

Lo-Fi prototypes
These two concepts are transformed into Lo-Fi prototypes to test the interactions when people use the concept designs, as shown in Figure 35.

Concepts 1 and 2 are evaluated in a 20-minute session with three IDE students in which the working principles of the concepts are demonstrated and evaluated. With this session in mind, the concepts are ranked in a Harris profile in the next section.

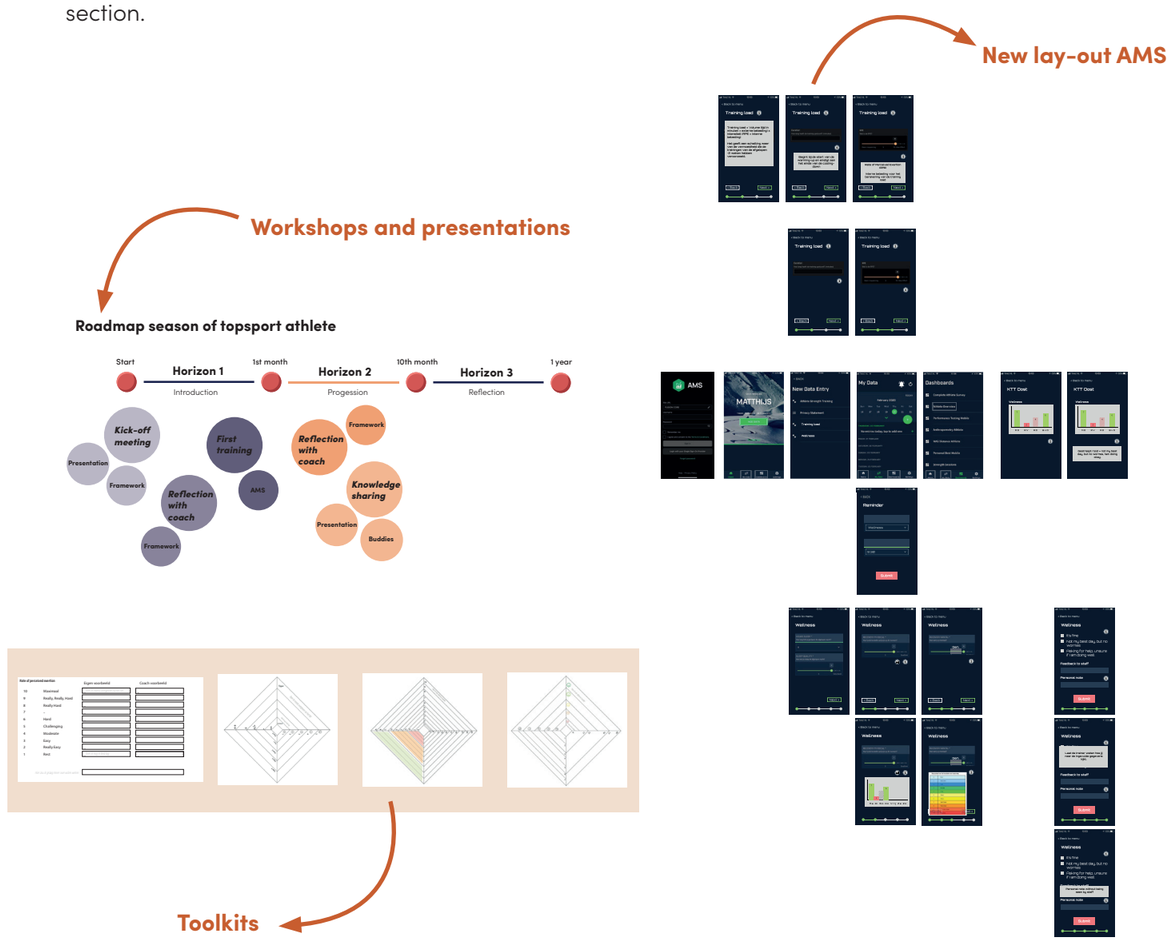


Figure 35: Lo-Fi prototype of concepts 1 & 2

4.1.3. Selection Process

The two lo-fi prototype concepts are evaluated using a Harris Profile. A Harris Profile is a visual representation of the strengths and weaknesses of a concept solution on a selection criterion, in this case, interaction qualities (Van Boeijen, A. et al, (2020)). The criteria are ranked from most important to least important and the scores for both concepts are shown in Figure 36.

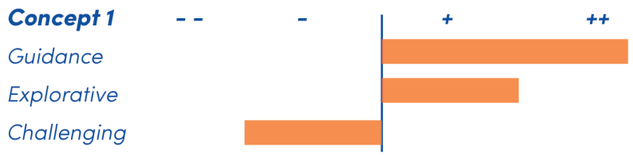


Figure 36: Harris Profile for concept 1 & 2

Concept 2 is more athlete-centered and leaves less opportunity for the athlete to provide direct feedback to the coach when assessing their mental health status. A more active method of feedback is what communication will encourage. Therefore, the development of Concept 1 will continue in the next section.

4.2 Concept Development

This section focuses on the further development of the concept chosen in 4.1.3. The chosen concept will be transformed into a Hi-Fi prototype and the different parts of the concept will be explained in 4.2.1. In 4.2.2 the concept will be evaluated by a number of different experts within and outside the KTTs, and in 4.3 a summary of the final improvements to the concept will be addressed in order to finalise and test the final design in the next chapter.

4.2.1 Explanation of Concept Parts

The chosen concept includes a roadmap with presentations and workshop sessions as explained in 4.1.2. In order to implement improvements in communication in the long term, the focus should not be on a single moment, but on several moments during the season.

This roadmap is an addition to the current year's schedule based on the findings in 2.2 and summarises the athletes' wishes and needs for what they missed during the season or what is still missing.

The roadmap is divided into three time periods called horizons: Introduction, Progression and Reflection, connected to a full season of a talented speed skating athlete, starting in May and ending in March, as can be seen in Figure 37.

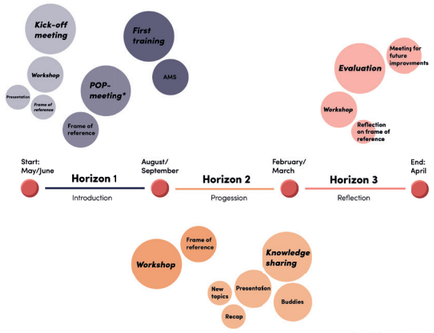


Figure 37: Roadmap divided into three horizons connected to a full season of a Talented Speed Skating Athlete.

Introduction period

The first horizon has three elements, as shown in Figure 38, and focuses on providing information on how to use the monitoring system to assess the athlete's health. In a bi-weekly meeting between the coach and the athlete (POP meeting), the results of the data entered by the athlete are discussed, and whether the use of the monitoring system should be clarified on how to use the AMS applications during the first training sessions when the athletes have to measure their health status.

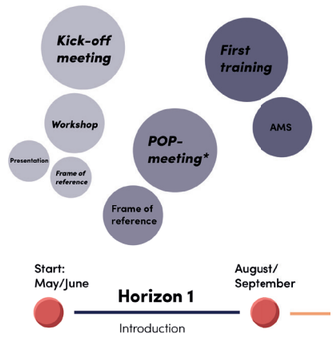


Figure 38: Horizon 1: Introduction

Progression period

The second horizon has two elements, as shown in Figure 39, and focuses on sharing knowledge about overtraining and prevention, staff expertise and explaining their interpretation of athletes' data results or how the experts can help them, and additional workshops such as 'How to create a sportsman's mindset', 'How to analyze your data as an athlete', etc. Buddies are formed between junior and senior athletes to check in monthly on how they are coping with stress and pressure during the season. This period of knowledge sharing helps the athlete develop a reflective mindset to prevent overtraining and encourage progression.

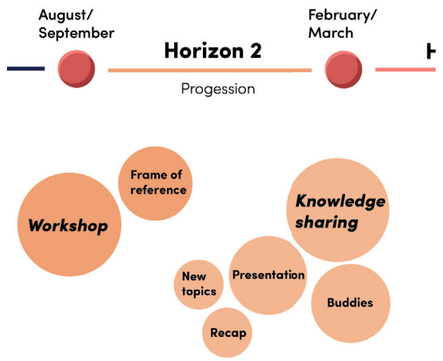


Figure 39: Horizon 2: Progression

Reflection period
The third horizon has one element, as shown in Figure 40, and focuses on a more in-depth evaluation of the (monitoring) systems used during the season. An annual Questionnaire is used to evaluate and develop the monitoring systems for the next season. It is important to schedule physical meetings with athletes and coaches to gather information on whether the use of the health Questionnaires and workshops is clear.

It is also important to evaluate what the athlete has learnt about their reflective abilities in the workshops during the season and to carry this forward into the next season.

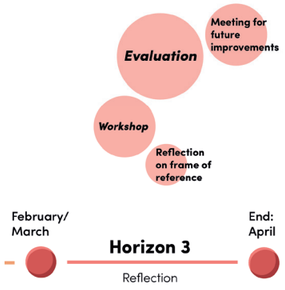


Figure 40: Horizon 3: Evaluation

An effective moment in time
At the beginning of each season, a kick-off meeting is held to inform athletes about the monitoring systems that the KTTs will be using during the season, such as AMS. Clarification of information about the monitoring systems would be most effective during this kick-off meeting and can evolve in less confusing at other times during the season. Therefore, a workshop session held during the kick-off meeting on how to measure and assess the Questionnaires in the AMS application is described in more detail in the next section.

More detailed information on the recommended presentations and workshops of Horizons 2 and 3, supported by the findings of 2.2, can be found in Appendix H.

Kick-off Workshop
The workshop focuses on what is expected of athletes when they are asked to assess their health status in the AMS, and on communicating what staff do with the data they receive from athletes.

In the workshop, athletes are asked to create an individual frame of reference for the mental health scales. In 2.2 it became clear that athletes and coaches have difficulty in assessing the mental health scales in the Wellness Questionnaire. Furthermore, athletes mentioned that health Questionnaires don't always match their expectations of what they think helps measure their mental health. Therefore, a template is developed to generate a frame of reference from a scale used in the Questionnaire, as shown in Figure 41.

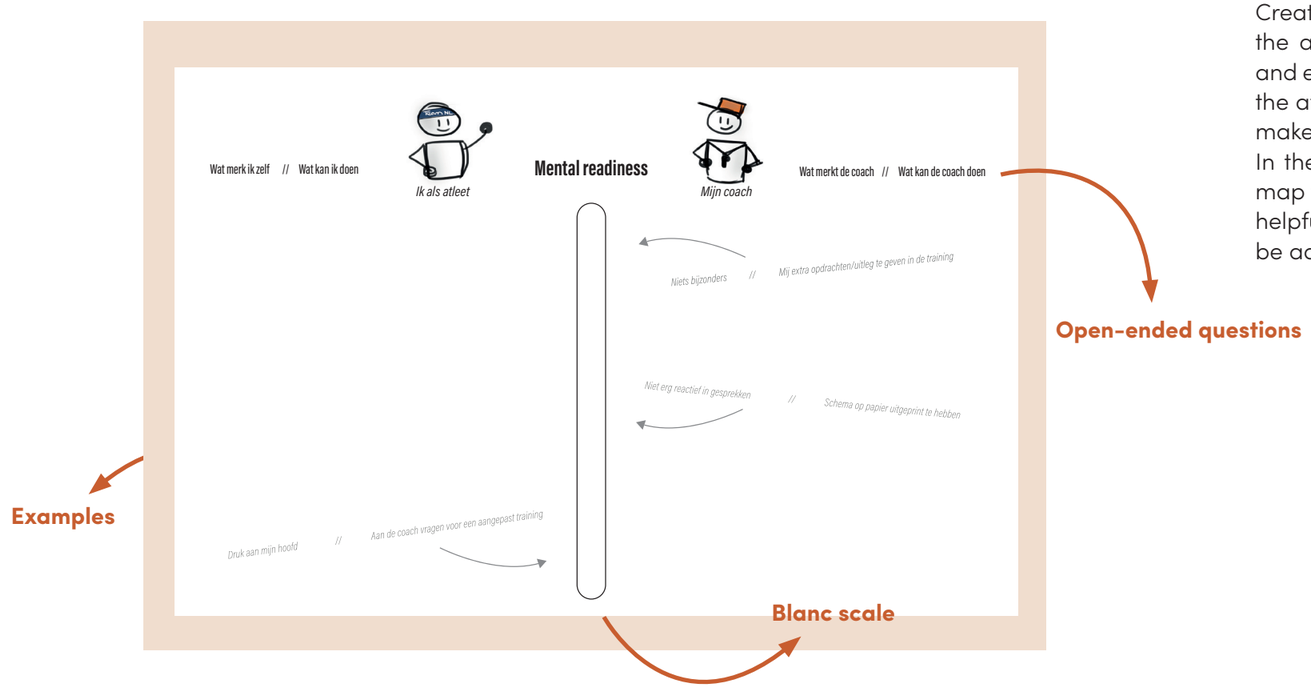


Figure 41: Template of a reference framework

In the center of the template, there is a blank scale. Athletes can add elements to the scale to personalise it and better assess their mental health. Elements can be numbers, colors, etc.

In this example, the Mental Readiness health scale is chosen from the Wellness Questionnaire. White space is added to both sides of the scale to provide space for examples of athletes experiencing high or low mental readiness. The left side focuses on the athlete themselves, with open-ended questions about "what do I notice // what can I do" as an individual. The right side focuses on the coach's support. Open-ended questions are "What does the coach notice // What can the coach do". These questions are asked to stimulate the reflective capacity, based on the Signaling Plan in 2.2.2.

Creating your own personal reference will help the athlete to reframe the scale with elements and examples that resonate with them. This helps the athlete understand how to use the scale and makes it easier to reflect on mental health scales. In the next section this template and the roadmap will be validated to see if the questions are helpful or what kind of missing elements should be added.

4.2.2 Evaluation of Concept Parts

Goal of validation sessions
The goal of the test is to get input and feedback on parts of the concept in 4.2.1 for improvement and to see if it's suitable for the context of use through scenarios. The parts of the concept that will be evaluated in this section are the roadmap and the kick-off workshop.

Set-up and participants
A pilot was carried out to test the flow of the story with IDE students before testing it with the target group. The roadmap is evaluated by the embedded scientists and the project manager of Innovatielab Thialf to check if the proposed presentations and workshops fit into the context and the year's schedule. The kick-off workshop is evaluated by athletes, a coach, a sports psychologist, a NOC*NSF expert on AMS, and a PhD student from TU Delft on personal data.

The roadmap was evaluated in an online meeting using PowerPoint slides to illustrate how the map worked. The kick-off workshop was evaluated in a physical meeting where the template was printed on paper. To test the context of use, I used scenarios to explain parts of the concept at the right time.

Planning and validation
Each evaluation session lasted 30 minutes. The questions asked are based on how the concept will improve communication between coach and athlete and how the target group will experience and interact with this concept idea in their context of use. Furthermore, to see if it helps the athlete in their reflection process to assess mental health scales, in this case, 'Mental Readiness', and to see improvements in the elements used.

A detailed plan, including questions to be asked of athletes and coaches during the evaluation sessions of the concept parts, is presented in Appendix I.

In between iterations
After each evaluation session, new iterations are performed based on the results in order to adapt and prepare for the next evaluation session on the same concept part. Therefore, small intermediate iteration steps are performed and annotated in the following sections.

Roadmap

Experts: Two embedded scientists and one project manager of Innovatielab Thialf

The goal of this concept evaluation session was to assess whether the roadmap fits into the current and revised yearly schedule in terms of the timing of the proposed presentations and workshops. It also assessed the added value of the proposed activities in order to avoid duplication and unnecessary work.

Results: The proposed annual planning fits well with the vision they have for the upcoming season. Some aspects that still need attention and have not yet been adequately addressed are mentioned in the new roadmap, such as the Wellness Questionnaire.

Improvement: The annual plan consists of a four-week period. At the end of each cycle, a meeting is scheduled with the coach to review the previous four weeks and to create a plan for the next four weeks with the embedded scientist. This four-week period can be used as consistent reflection moments in the roadmap.

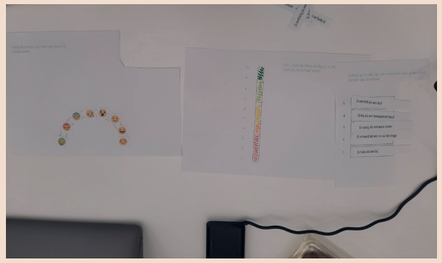
Kick-off Workshop

Goal of pilot test: The template for creating a reference framework has different elements and to test the right fit and shape, these elements are evaluated using a Minimum Viable Product (MVP) methodology. The definition of an MVP is to test product features and validate the product idea at an early stage of product development when investment costs are not yet high (Minimum Viable Product (MVP), (2022)).

Experts: Six IDE students

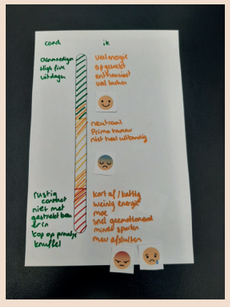
Results:

Pilot 1



Pilot 2

Pilot 3



Insights

- Language can be interpreted in different ways. Colours and emoticons are more universal and easier to understand for expressing your mental status.
- Different associations are related to checking in on your mental state. Therefore, an extra step is needed to ask the participants the associations with the 'Mental Readiness' aspect.

Kick-off Workshop

Goal of evaluation test: Identify improvements to the concept and see if it is suitable for the context of use.

Experts: One coach and four senior athletes.

Results: Questions asked during the validation session can be found in Appendix J & results in Appendix K.

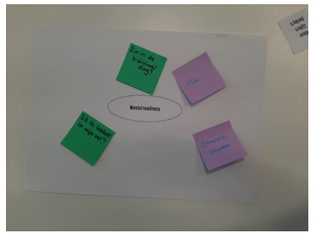
Coach

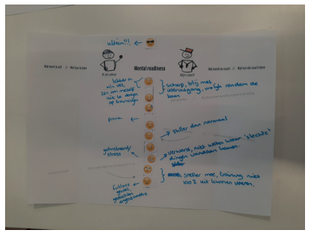
It is important to ask coaches if they understand the definition to create clarity for athletes and to properly evaluate the data coaches receive.

Key takeaway

- It needs to be practical and proven before coaches want to implement something new due to limited time available.
- Coaches in KTT's work most of the time on a voluntary basis. They cannot keep track of all the athletes' needs, so it would be helpful if the athletes were proactive about what kind of help they need.
- It is not yet feasible for a coach to create a mental readiness scale. It is more interesting to do this for the RPE scale, where both coach and athlete have to rate the intensity of the training.

Athletes





Mental health scales are correlated and therefore it is difficult to define the differences between them.

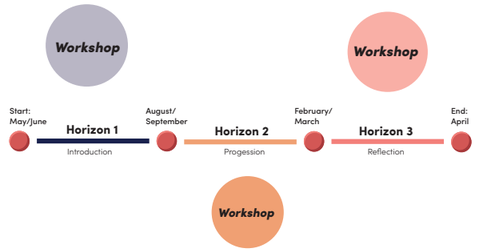
Key takeaway

- A framework is dynamic and will change during the season
- Athletes would like to have the confirmation how the coach looks at the data and what the coach expects of his athletes when they fill in the scales.
- The associations of 'Mental Readiness' vary in answers from athlete and coach. This can also be a result of the continious development of the Wellness Questionnaire
- The digital translation of the created scale is preferred as a photo or implemented in the slide bar.
- The ability to reflect is more difficult for junior athletes due to less experience and lack of guidance if they have never done this before.
- Coaches need to take an active role in guiding athletes to reflect on their health and therefore it is even more important to start a conversation if there is a difference between positive and negative numbers

Goal of evaluation test: To identify improvements to the concept by evaluating the possibilities of digital implementation with an expert on Teamworks AMS from the NOC*NSF, and to identify how the reflective process of an athlete can be supported with a sports psychologist and a PhD student from the TU Delft who is an expert on sovereignty over personal data.

Experts: Sports psychologist, NOC*NSF expert on AMS and PhD candidate of the TU Delft

Sports psychologist



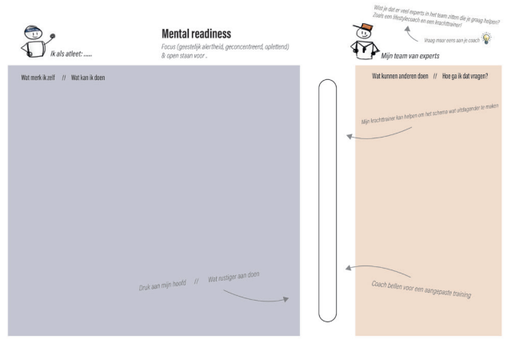
Research findings of 2.2 are confirmed

Key takeaway

1. It may be the case that the junior athlete does not yet have the ability to reflect on himself. So you need to support that in e.g. a conversation
2. It's important what the next steps are for the staff, what they do with the information when they receive mental data

- Encourage the proactive attitude of athletes
- Coaches need to reflect on the positive and negative differences in the data. Use the power of the team and inform more experts in the team if an athlete differs from his average.
- Keep the framework dynamic and reflect 3 times a year.

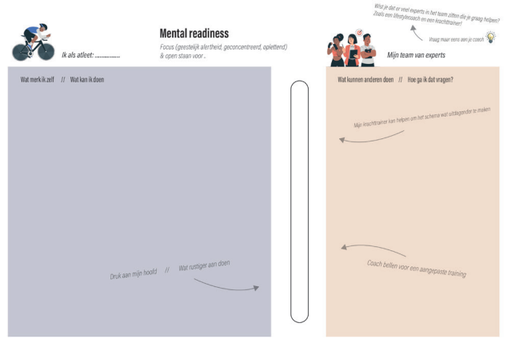
NOC*NSF expert



Key takeaway

- The need for digitisation among athletes is in line with the current possibilities of the application.

PhD candidate

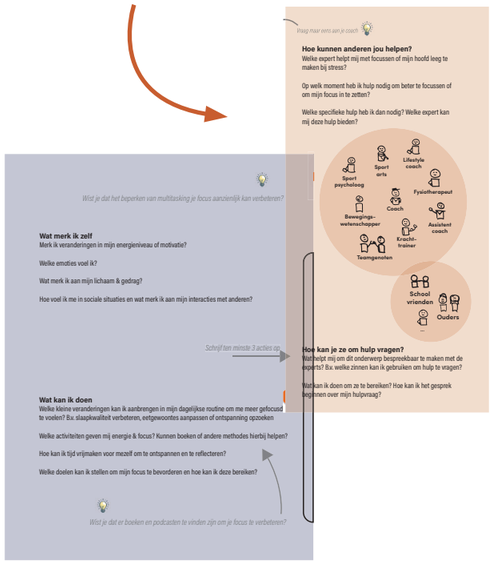


Key takeaway

- Add more concrete questions to support the athletes' reflection process.
- Create a booklet to provide more space for examples.
- Effective long-term implementation can be achieved by using Gibb's reflective cycle.

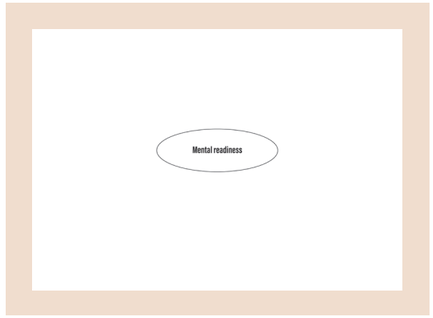
4.3 Final Concept Direction

Open-ended concrete questions

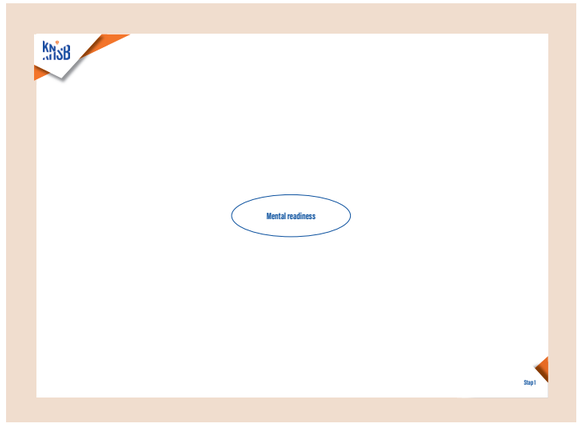


Presentation for coherence

Mapping associations



Translated in the corporate identity of the KNSB



Based on the results of the evaluation session discussed in the previous section, the concept parts have some room for improvement. As the roadmap is focused on long-term implementation, the final design in the next chapter will focus on improving the kick-off workshop to test the direct impact on communication between coach and athlete.

Points of improvement are summarized, concluding from the results of section 4.2.2:

- Add more open-ended concrete questions to the framework template to guide the athlete's reflection process. Discuss how the coach will look at the data and the actions that will be taken to give the athletes more confidence in the use of the Questionnaire and its implementation.
- Add an extra step (1) to the workshop, by mapping out the associations of the athletes and coaches. Discuss similarities and differences and compare with the definition in the literature to have a guide for distinguishing the other aspects of the Wellness Questionnaire.
- Add an extra step (3) in the workshop to make the results of steps 1 & 2 available digitally.
- Add the associations created in step 1 to the subline of the digital Questionnaire in the AMS application.
- Add the possibility to upload a photo of the created frame from step 2 in the AMS application.
- Create coherence between the set of elements by making a presentation to connect the different steps of the workshop and add additional information to explain what staff do with the information when they receive mental health data.
- All templates should be in line with the corporate identity of the KNSB
- Mental health scales are the most difficult to assess, for the final design I will focus on one mental health scale: 'Mental Readiness'

The final points of improvement are included in the final design and are presented in the next chapter.

5. Deliver

The last and final phase of the double diamond is the 'Deliver' phase. This chapter focuses on presenting the final design. The first section will explain the context of use in 5.1. In the second section, we will go deeper into the evaluation of the final design in 5.2.

5.1 Final Design

5.1.1 Workshop: Reflect & React

The final design is a workshop session called "Reflect & React", which consists of three steps guided by a presentation, each with several exercises. The workshop is designed to support athletes in guiding and communicating with their coach about the Wellness Questionnaire. Lastly, a roadmap is shown to see the context of the implementation of the workshop.

Athletes start each speed skating season with a kick-off meeting about the monitoring systems they will use. This is currently done by a presentation given by the embedded scientist. The final design is an addition to this presentation. Directly after this presentation, the workshop session will start. First, a small introduction about the workshop session is given to what athletes can expect. After that, the three steps will be introduced, and practiced, as shown in Figure 42 or seen in Appendix L.

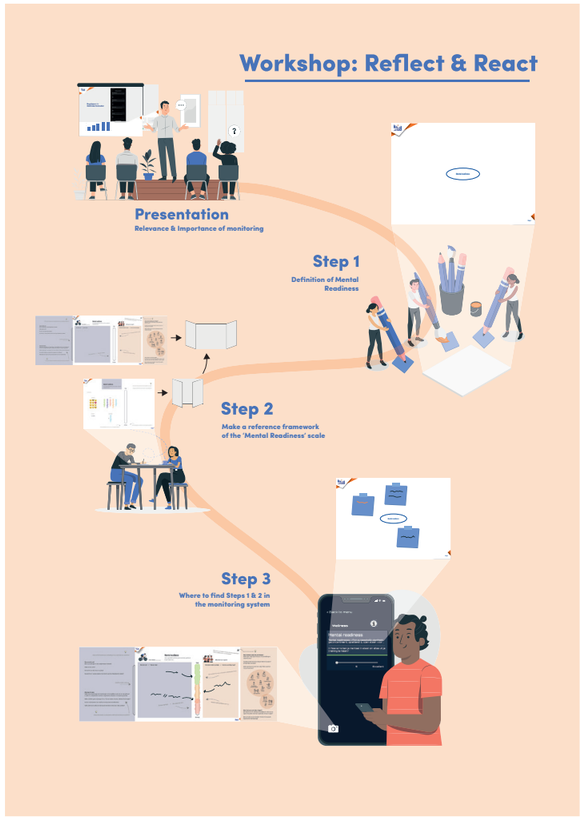


Figure 42: Steps of the workshop session

Presentation
In addition to the current kick-off meeting presentation will be given, emphasizing the importance of monitoring, and how athletes are individually analyzed. The presentation will be presented by the coach with guidance from the embedded scientist where necessary. Because the coach plays an important role in motivating the athletes by using the monitoring systems that are presented.

The presentation includes a step-by-step plan to complete three different steps. The end goal of the workshop session is to let the coach and athlete be on the same page in terms of communicating about the terms of the Wellness Questionnaire. For the validation of the design goal, the workshop session will focus on 'Mental Readiness', as this is one of the most difficult terms for athletes to know what is expected of them. The presentation slides with an explanation of the slide can be seen in Figure 43, and in Appendix M.

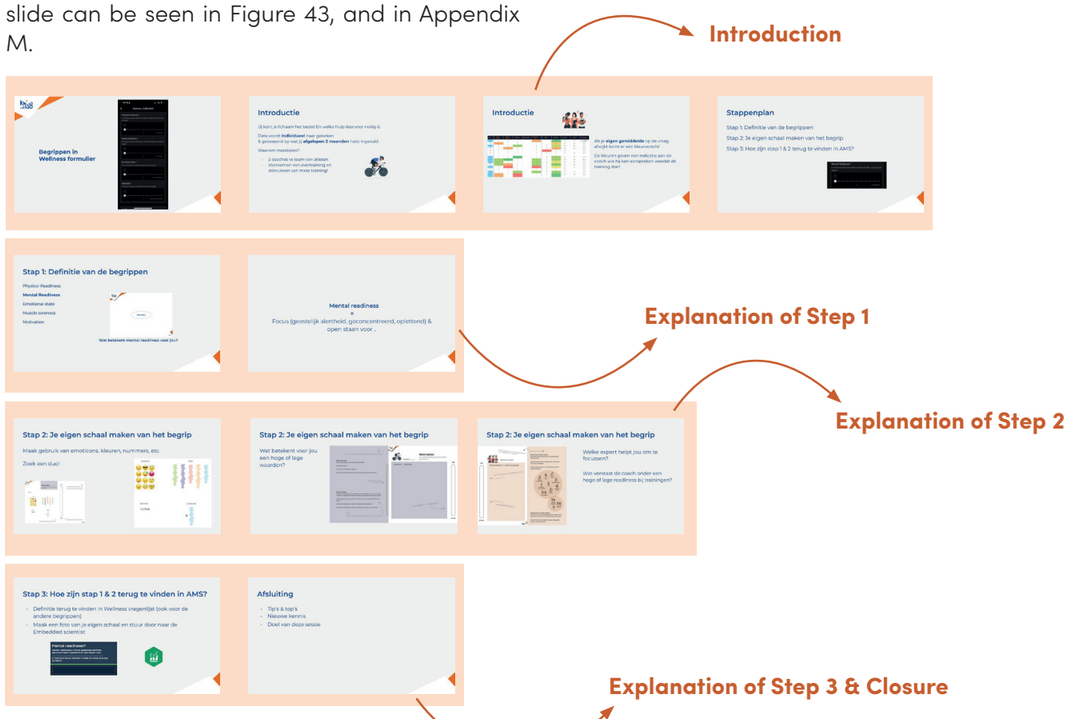


Figure 43: Presentation slides

Step 1: Definition of Mental Readiness
There are 5 definitions in the Wellness Questionnaire. The first step in the workshop is to define one of these 5 terms, in this case, Mental Readiness. Each team member, including the coach, is given a post-it note and pen to write down their associations with the term on what comes to mind when they think of it. The coach has an important role to play here. The athletes like to have feedback on how the coach interprets the term, and with what mindset he looks at the Mental Readiness data.

After writing it on a post-it note, the participants place their association on the paper template shown in Figure 44 or Appendix N. This creates a word web of the associations that the athletes and the coach have with the term mental readiness and whether this matches.

After discussing the associations of the team members and the coach, the definition of the term Mental readiness according to Kölling et al. (2019) is shown to compare the team's associations with the literature. This should act as a guide as to what type of associations are related to mental readiness to distinguish it from the other terms in the Wellness Questionnaire.

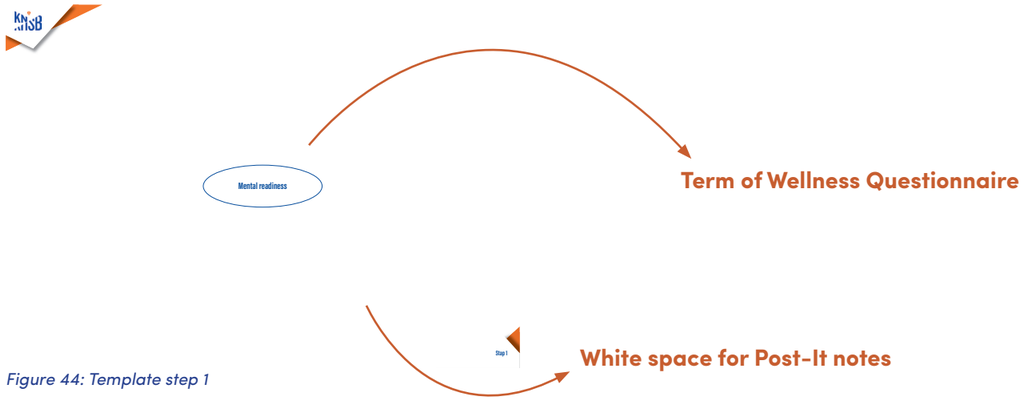


Figure 44: Template step 1

Step 2: Make a reference framework of the 'Mental Readiness' scale

The workshop's second step focuses on making an individual reference framework for the 'Mental Readiness' scale. For this task, the group is divided into pairs of 2 so that they can discuss the tasks together. Each team member is given their booklet and tinkering material as shown in Figure 48 and 49 or Appendix N. The coach, and embedded scientists will be in the room to provide guidance and help during the exercise.

Figure 45: Blanc scale of 'Mental Readiness'

The first task in this booklet is to create your scale of 'Mental Readiness', with on top of the scale being ready and the bottom not ready, as shown in Figure 45. You can use colors, emoticons, numbers, or a combination of these to complete this task. The booklet gives tips and ideas on how to create their scale, and definition of the term according to the literature found on the front page of the booklet.

Figure 46: Left side booklet

The second task is revealed when they unfold the left side of the booklet. This part focuses on what the athlete has noticed about him and what he can do for himself when he feels ready or not ready. The answers can be written in the text field. If the athlete doesn't know where to start, there are open and concrete questions on the left-hand side of the unfolded booklet to guide the athlete in what kind of answers he can give. What the athlete notices may be energy levels, emotions, or perhaps bodily sensations or mood patterns. Examples in the text field are given to inspire the athlete on how to answer the question, as shown in Figure 46.

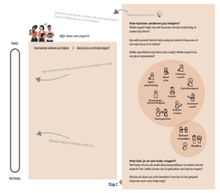


Figure 47: Right side of booklet

The third task is revealed when they unfold the right-hand side of the booklet. This part focuses on what others can do, and how they can ask for help. If the athlete doesn't know where to start, there are open and concrete questions, and examples on the right side of the booklet. Examples include an illustration of their staff in KTTs as well as family members or friends of their social environment outside Thialf, as shown in Figure 47.

The second and third tasks are based on the literature theory of signaling plans, which can be found in 2.2.2. for preventing overtraining. Recognizing the signals that can lead to overtraining is an important reflective skill to have.

After the third task, the coach will say what he expects if the athlete has a high or low readiness during the training and what kind of next actions the coach will take. Currently, the coach gets already an indication in colors if the data e.g. Mental Readiness of the athletes differs from their average. Those colors indicate if the athlete feels ready or not ready and give a sign to the coach of what the coach can ask from his athletes in the training if they are up for a challenge or do they just want finish the training.

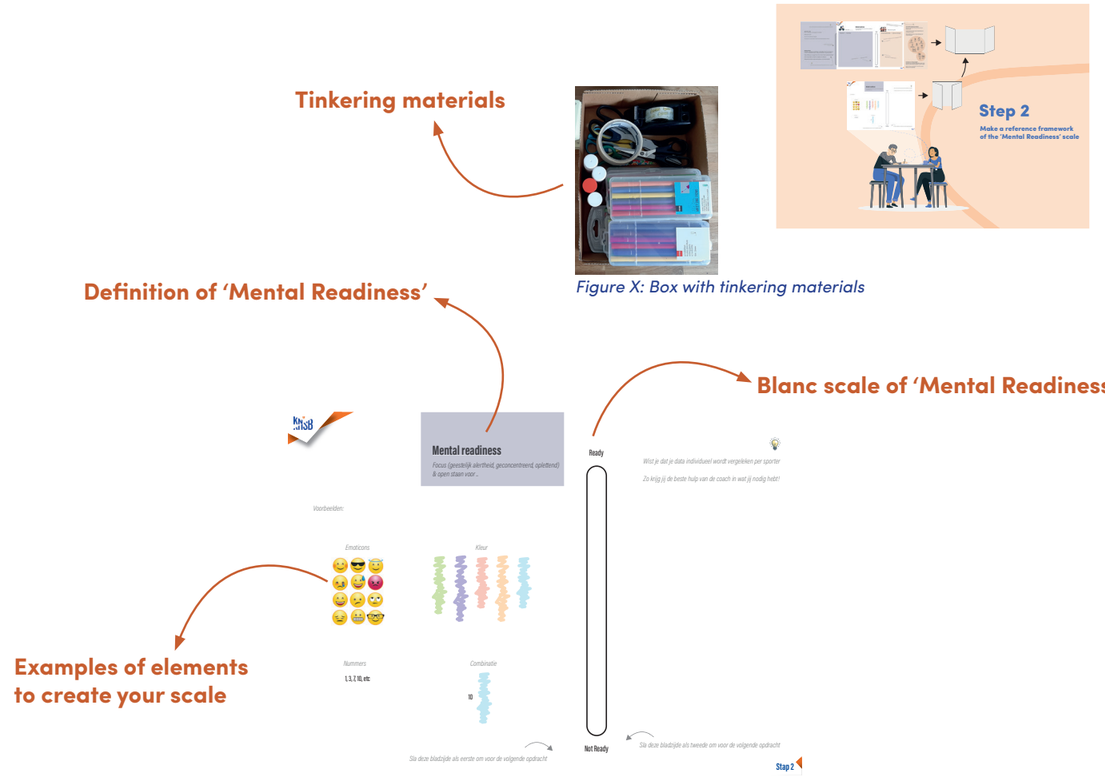


Figure X: Box with tinkering materials

Figure 48: First task of Booklet for step 2.

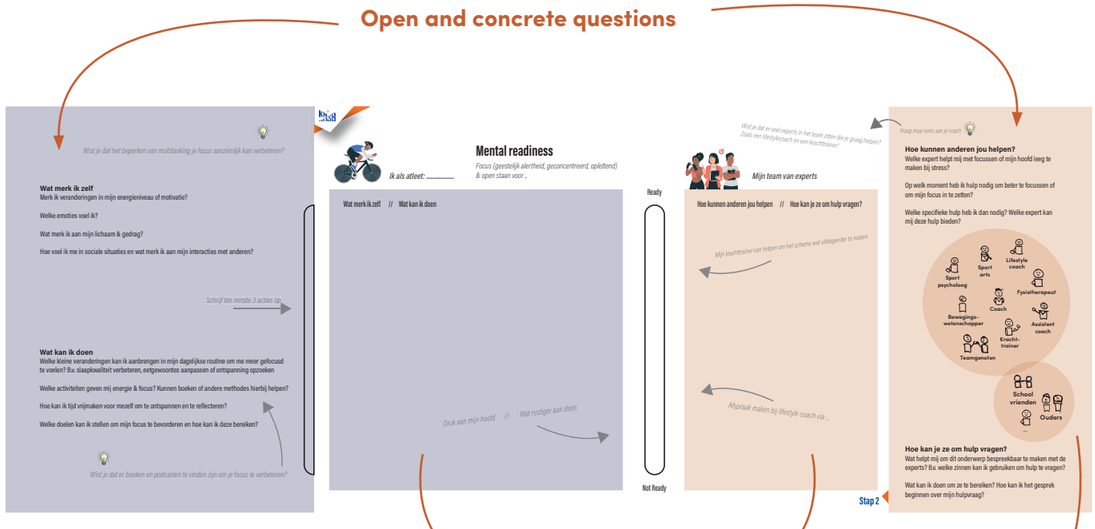
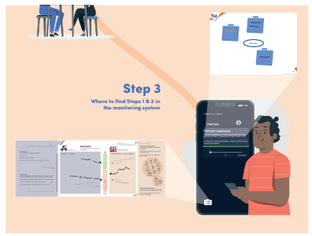


Figure 49: Left side is second task, and right side is third task of Booklet for step 2



Step 3: Where to find Steps 1 & 2 in AMS
The final step of the workshop focuses on why the athletes are doing this workshop, and where to find the end results of steps 1 & 2.

There is a short discussion about what the athletes think, the aim of the workshop is to let them think for themselves about the benefits of executing the workshop steps. After that, an explanation is given of where the athletes can find the results of steps 1 & 2.

In step 1, the team defined associations around the term 'Mental Readiness'. These associations are integrated into the subline of the digital Wellness Questionnaire as shown in Figure 50. This component in the application will act as a reminder of what the team mapped out during the workshop.

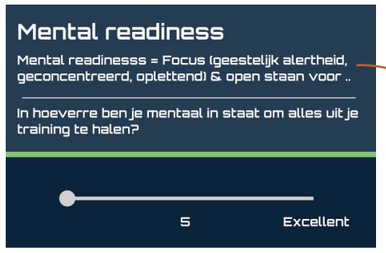


Figure 50: Associations integrated in the subline of the Digital Wellness Questionnaire.

In step 2, the athletes individually defined a reference framework for the Mental Readiness Scale. A photograph of this framework should be sent to the embedded scientist so it will be added to the AMS application. In this case, the athletes will have a digital version of the reference framework they have created to refer back to when they need to measure their Mental Readiness.

Goal of each step
The goal of step 1 is to map out the associations that athletes and coaches have with Mental Readiness. To see whether this matches and if they are on the same page when athletes measure or coaches review Mental Readiness data.

The goal of step 2 is to make the coach's actions more visible to the athletes. Furthermore, to have a better understanding of what the term means and how the athletes should reflect. In the long run, it should help the athletes in their reflective ability to see what they need for their body to prevent overtraining and to make progress. This step can encourage a proactive attitude to engaging staff or their social environment when they need help.

The goal of step 3 is to make the previous steps practical in use for athletes when they need to measure their Mental Readiness. Moreover, it lets the athletes think about the benefits of communicating with the coach about the Wellness Questionnaire to make progress in their sports development.

5.1.2Roadmap
Implementation of the final design is most effective at the beginning of the speed skating season when the athletes are introduced to the team and briefed on the latest updates to the monitoring systems they will be using during the season. To achieve this goal of long-term implementation of the workshop session, a roadmap is created for one season of a top sports athlete, as shown in Figure 51.

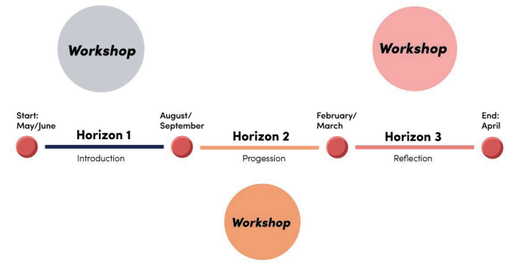


Figure 51: Long-term implementation of the workshop session.

The reference framework created in step 2 of the workshop is like a goal. They are dynamic and will develop during the season. For effectiveness, the workshop should be executed at least three times a year. This will create more trust among athletes in the monitoring systems to see the implementation of the workshops in the Questionnaires and guidance of the staff in more individual training programs when receiving Mental Readiness data.

Horizon 1
The introduction period of the speed skating season takes place during the summer to prepare for the winter season full of competitions. The implementation of the final design during the kick-off meeting will help later in the POP meeting (read: Personal Training Plan) and the first training sessions when the athletes have to measure their Mental Readiness in practice. During the POP meeting, the coach and athlete can discuss the results of the Wellness Questionnaire. Step 2 can help the coach to get to know his athlete and to understand the athlete's intentions when filling in his Mental Readiness data.

Horizon 2
The Progression period takes place at the beginning of the winter season. A short recap of the kick-off meeting is proposed to refresh the athletes with information and updates on the monitoring systems. In addition, during the summer, the junior athletes experimented with reflecting on their Mental Readiness status. It is therefore important to create a new frame of reference to incorporate the knowledge gained from the summer season into this new period of the season.

Horizon 3
The reflection period takes place at the end of the winter season when the competitions are over. For the last time, athletes will reflect on the knowledge they have gained during the winter season by reflecting on their Mental Readiness status. So that they can take these conclusions with them into the next year's season.

Future implementation
The final design is the first step in improving the communication between athlete and coach of the AMS monitoring system. In addition to the workshop sessions, a more in-depth consultancy report is written for the client on how to improve communication, providing additional presentations and workshop sessions in the long term. These additional suggestions should be developed in future research and are based on the findings in 2.2.4., and are shown in Appendix H.

5.2Final evaluation

The final design is evaluated to determine if the design goal in 3.2 has been achieved. This section discusses the research objectives, the test set-up, the results, and the validation of the design objective. The user tests are conducted with junior athletes and coaches of the KTTs to assess the effectiveness and desirability of the design.

5.2.1Research objectives

Two main research objectives were set to test the validation of the achievement of the design goal in this final evaluation session. The interaction vision, wishes, and requirements should be kept in mind when evaluating the design goal.

Two main research objectives

- The design goal has been achieved
- Identify improvements to better align with the design goal

Research objectives in the final design

The research objectives are linked to elements of the final design to validate the achievement of the design goal.

Therefore, the *first research objective* is divided into three sub-objectives. After each sub-objective, the final design is linked to these objectives:

1. Improve the communication of information about the usage of AMS by the coach and confirm the next steps in the coach's feedback.

Final design: the implementation of an additional presentation given by the coach and supported by the embedded scientist when necessary.

2. Improve guidance on what is expected when athletes reflect on mental health status in AMS

Final design: by implementing the three steps of the workshop and providing information in the application afterwards.

3. Improve communication on self-reporting by athletes to normalize not being at their best every day, and give more guidance on how to grow in the reflective capability on the health conditions of athletes.

Final design: by writing recommendations for the long-term goal

The *second research objective* will be achieved by providing a template with tips and tops in the final evaluation session to identify improvements in the session to find out if the tasks are clear to follow.

Interaction vision

In 3.3 interaction qualities were identified to define how the interaction with the final design should feel. These qualities, guidance, explorative and challenging, are linked to the final design.

Guidance is validated in the workshop session by practicing it together and picking it up alone after the session. Multiple sessions are reflected in the long-term implementation, which can be seen back in the roadmap.

Explorative is validated in the final workshop as they can choose their own tools to carry out the steps, it is easy to start and after the workshop, they can start again whenever they feel the need, for example in the POP meetings with the coach.

Challenging is validated in the workshop sessions to give space to try and get support from the coach or embedded scientist if they need more help on the first try. The challenge should not be too hard, as this will influence later attempts.

5.2.2Test set-up

Pilot test

To test the final design, a pilot test was carried out with two students from TU Delft. Small changes were made to the presentation and template from step 2, as shown in Figure 52 and 53.

- Presentation: More explanation of picture of dashboard presented in slide 3.
- Step 2: Modification of the examples of the first task and higher quality of the booklet.

Figure 52: More explanation of photo in slide 3

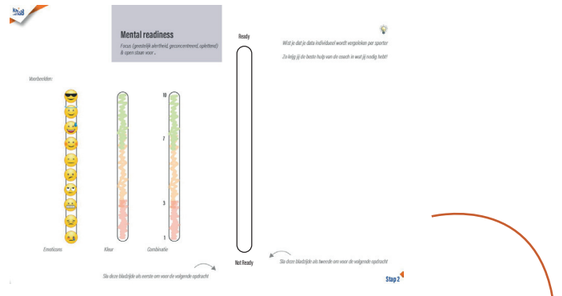
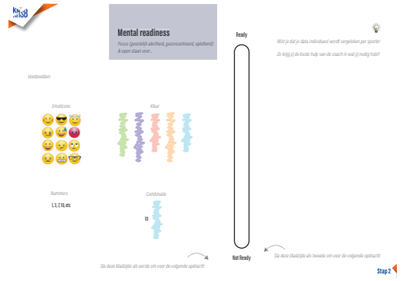


Figure 53: Changing the front cover of the booklet in step 2



Participants, structure of tests, and duration

The final test evaluation session was conducted with two KTTs. The session is divided into two parts where the KTTs (on average 15 athletes aged between 15 and 25 years) attend the kick-off meeting for the first part. The second part, an interview of 10 minutes per participant, was conducted one week later with 4 athletes per group. Group 1 did the additional workshop session after the kick-off meeting, which added 30 minutes to the meeting.

There are differences between the participants in terms of the number of times they have participated in a KTT, how good their reflective skills are, and how familiar they are with the team's way of working. These differences are not a problem, as there is often still a misunderstanding about the expectations of the coach and what the athlete thinks he has to do.

The reason for testing my final design with two KTTs is to validate the final design with junior athletes, as the interviews conducted in the Discover phase are with almost senior athletes. The Wellness Questionnaire is constantly evolving and changing during this graduation project. Therefore, the test was to see where the (lack of) clarity is with the updated Questionnaire.

Step-by-step plan of Workshop session Group 1
The workshop session is introduced immediately after the general kick-off meeting. The planning for this session can be found in Appendix X. Specific information on what can be seen in the presentation and the three steps of the workshop tasks can be found in 5.1.1. The assignment of each step is summarised below.

Step 1:
Definition of mental readiness

Step 2:
Make a reference framework of the 'Mental Readiness' scale

Step 3:
Where to find Steps 1 & 2 in AMS

Step 4:
Write tips and tops on a post-it note from steps 1 & 2 and place on template tips/tops, seen in Figure 54. To indicate what was clear or unclear to identify improvements in the final design.

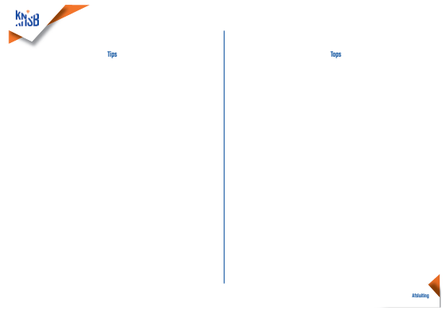


Figure 54: Template tips/tops

Lastly, an interview session with four athletes will be held a week later. Therefore, an announcement is made for athletes to look back at the workshop session later this week. After the session, a short evaluation session is held with the embedded scientist and coach. Furthermore, the definition created during the session is sent to the NOC*NSF expert who will implement it in the AMS on the same day.

Validation questions
The aim of the workshop session is to test the research objectives in my final design. The validation questions are linked to the research objectives to validate the different steps. A brief summary is given in Figure 55. The specific questions asked can be found in Appendix O.

Directly after kick-off meeting **Group 1**

Tips/tops for improvement final design

One week later

Improve guidance when reflecting (Objective 1)
Understanding expectations of term (Step 1)
Reference framework (Step 2)
How often used during the past week
Help of framework in reflection process
Help of subline in reflection process (Step 3)

Improve communication about next steps of coach (Objective 2/Presentation)
Reason behind coach want to know Mental Readiness
Expected next steps of coach and individual acticns on Mental Readiness

One week later **Group 2**

Improve guidance when reflecting (Objective 1)
Understanding expectations of term
Most difficult term in Health questionnaire
Search for help when unclarity of questionnaire

Improve communication about next steps of coach (Objective 2)
Reason behind coach want to know Mental Readiness
Expected next steps of coach and individual acticns on Mental Readiness

Figure 55: Validation question groups 1 and 2.

5.2.3 Results

Workshop session group 1

Step 1: Definition of Mental Readiness

During the session, a word web is created from the associations of the athletes and the coach, as can be seen in Figure 56. The associations of the athletes and the coach are comparable, but the athletes have a wider range of associations with mental readiness. If we compare them with the definition in the literature, focus correlates with the athletes' answers. The associations made are almost on one line but differ in their use of words.

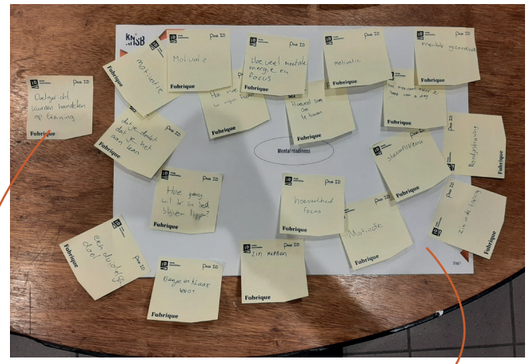


Figure 56: Results of step 1

Answers of athletes

Answer of coach

Step 2: Make a reference framework of the 'Mental Readiness' scale
Junior athletes have more difficulties in completing the tasks within the given time. Looking at the results generated, there was a difference between the answers of a junior and an older athlete, with the answers of the junior athlete being more general and using the same words at different positions on the scale.

Photos during the workshop and of results from step 2 are shown in Figure 57.

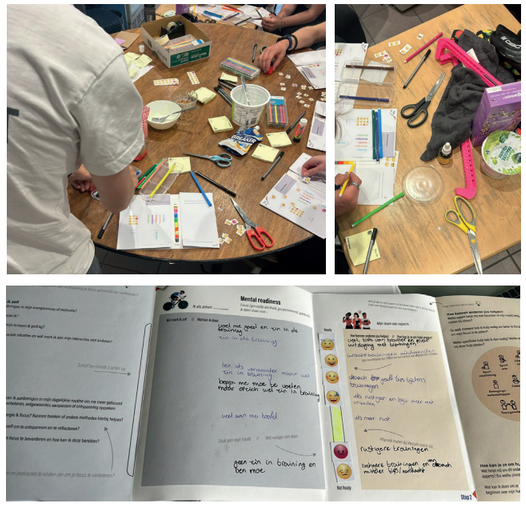


Figure 57: Athletes carrying out the assignments and results

Step 3: Where to find Steps 1 & 2 in AMS

No comments, was clear to everyone.

Step 4: Tips and tops for steps 1 & 2

In order to identify improvements to the final design, the athletes were asked to give a tip and a top for the session, as can be seen in Figure 58. Five athletes responded with a fun creative task that was clearly explained and fun to work. Tips were limited amount of time for tasks, other terms in Wellness Questionnaires should also be addressed, and a comment on more help in the process for the new task.

The last tip is in contrast to the first top. Therefore, it can be concluded that there is a difference in the athletes' ability to reflect in order to successfully complete the task.

The coach commented in the evaluation session that it's good to cover all the terms in the Wellness Questionnaire in the upcoming season to get a feel for it and to clarify the coach's view.

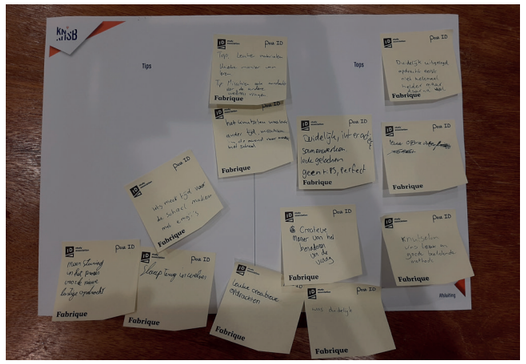


Figure 58: Results of step 4

Interview session Group 1
One week later five interviews were conducted with four junior athletes and one coach to validate my final design. Results are discussed hereafter.

Results athletes
Step 1 helped to improve expectations and guidance on how to reflect when athletes need to measure Mental Readiness in AMS. It also provided clarity on the coach's next steps if the athlete scores high or low on Mental Readiness. The scale can be used as a communication tool between coach and athlete when they want to have more or less challenges in the training program.

Step 2 has not yet been used. The athletes see speed skating training as requiring a high level of concentration and providing an indication to the coach of their 'Mental Readiness'. Two other participants mentioned that they had just joined the team, so the long-term benefits would be seen over a longer period of time. In addition, the athletes mentioned that the other terms in the Wellness Questionnaire should also be addressed in a workshop session. This is an indication of the desirability of the workshop session.

Step 3 is a good reminder and it helps to differentiate between the other terms used in the Wellness Questionnaire, in particular, the term 'focus' is helpful in this case.

Results coach
The coach uses AMS to get to know his athletes. The workshop session develops more clarity on both sides. If there is a difference in results, the coach starts a conversation about what the result is, where it came from, and what we can do about it.

The AMS results are discussed every two weeks. It is valuable to look at the answers from the workshop session, particularly Step 2, to see what the coach can expect from the data he is receiving from his athlete.

Interview session group 2
One week after the general kick-off meeting of group 2, four junior athletes are interviewed, and a summary of the results is discussed hereafter. In Appendix P, the results are more elaborated.

Results athletes
Athletes don't see the value in using the Wellness Questionnaire as a communication tool to encourage more training. All the athletes mentioned that low scores on 'Mental Readiness' are only valuable for the coach to take action. Athletes were aware of the time limit barrier of coaches.

Athletes mentioned that of the five terms, 'Mental Readiness' and 'Emotional State' were the most difficult to measure. These terms are very similar, interrelated, and mostly based on a gut feeling. Furthermore, the athletes used the same words to describe the definition of the other terms. A comparison with the coach's association was not possible, so it wasn't possible to validate the interpretation between coach and athlete.

Finally, all athletes will not ask for help if they don't understand the Questionnaire.

5.2.4 Design goal validation
For the final evaluation, two research objectives and sub-research objectives related to the final design were identified in 5.2.1. A conclusion will be drawn from the results of 5.2.3 on the achievement of the design goal in 3.2.

The design goal is achieved by improving communication about why and how to use AMS when athletes need to reflect on their 'mental readiness'. The workshop is therefore a valuable tool for coaches and athletes. The first steps in providing guidance on the reflective capacity of athletes are carried out in Step 2. It is important to develop this reflective capacity of the athlete by providing more reflection sessions to discuss the answers to Step 2. The long-term goal can only be validated later in the season to see the effects of the workshop session.

Group 1 stated that they would like to address the other terms in the Wellness Questionnaire in a workshop session and use the monitoring tool as a means of communication to encourage more or less training. This shows the desirability and effectiveness of the workshop. Group 2 confirmed that it was difficult to differentiate between terms related to mental health.

In addition, Group 1 confirmed one week later that they knew what was expected of them and that the coach's next actions were clear, which increases compliance in self-monitoring according to the paper by Bos, R. & Bekkering, A. (2019) and the theories of Saw, et al. (2015 & 2016). Furthermore, preventing a mismatch in communication between athletes and their coach will reduce the risk of under- or overtraining following Van Loon, J. (2021).

The interaction vision qualities are successfully integrated into the final design and establish the right interaction with the product. The long-term goal can be validated later during the season. In addition, the requirements and wishes are met if the coach takes an active role as a motivator in the usage of AMS if the staff provides guidance in the athlete's reflective ability, and takes the correct next steps when receiving mental data.

Improvements and recommendations for the final design are discussed in Chapter 6.

6. To Conclude

This final chapter concludes the report with a discussion of the long-term and future implementations, and limitations of the research and design activities undertaken in section 6.1. This is followed by a final overall conclusion and recommendations highlighting the desirability, feasibility, and viability of the final design in section 6.2. Concluding with a personal reflection in section 6.3.

6.1 Discussion

This section explains the future improvements and limitations of the research activities carried out in 2.2 and the design activities carried out in Chapters 4 and 5, which should be considered for future research.

6.1.1 Research and Design Limitations

Restrictions of Topsport settings

Limited access to participants

Restrictions in Topsport settings resulted in a time limit of 15 minutes for each of the eight interview sessions with a participant in the research phase. A time limit can be a barrier to having more time to think about the topic and express your ideas, or it can mean that icons are easily overlooked. Time was also limited for the validation and final test session to a maximum of 10 or 30 minutes.

The brainstorming and the first validation sessions are carried out with the students instead of the target group. Involving the target group in these sessions is beneficial to address the right problem and find their preferred solution, as well as the target group's attitude to the use of the final design, if they have also contributed a piece to it.

Further research should be explored to get a broader perspective from the coaches and embedded scientist and to confirm the findings from the athletes' perspective.

Extra time for preparation research set-up

In addition to the time constraint, there was a lot of paperwork involved in convincing the client of the methodology used. This paperwork was more time-consuming than planned. As a result, the start of the research was delayed and this led to a delay in the design part and the overall planning.

AVG rules

Furthermore, due to privacy regulations, monitoring systems are analyzed via screenshots or by observing the embedded scientist interacting with these systems. This limits the designer's ability to get a feel for the interaction and flow of using the platform.

Methods

Sensitizing beforehand

The embedded scientist invited the athletes and coaches to the interview sessions. All participants mentioned that the interview would be about 'Teamworks AMS' and could influence the participants' attitudes and the information given.

Toolkit

Black and white icons were used for the interview sessions. People respond differently to more color or typography and future research using this tool should include more different visual styles. E.g. landscapes, not perfectly made icons, different background colors, and typography.

Amount of test validations

Further test validation and iteration of the final design should be undertaken before implementation on a larger scale. To validate this way of reflection on 'Mental Readiness'. In addition, other terms from the Wellness Questionnaire should be considered, and how the relationship between them can be incorporated into the final design.

External factors

Limited reflective capability of athletes

Being reflective is a learning process for junior athletes that starts at the beginning of their top sports career. Because they haven't done it before or learned it elsewhere, it is important that they have some guidance in reflection to make this a successful learning curve. This reflection can be supported by the staff in the KTTs, but the time for these moments of reflection is limited. So another solution should be explored.

Next steps of staff

Even more important is the correct interpretation of the data received by staff to build confidence in the monitoring systems. If this confidence is not established, the willingness to use the final design will be questioned.

6.1.2 Recommendations

Improvements on the final design
For further development of the final design, the following improvements should be considered:
Workshop steps

- The booklet of Step 2 should include an option to add the associations made in Step 1 to the booklet, and it should indicate more clearly where to start. In addition, the booklet should focus on adding examples of experiences, which will make it more concrete and relatable for athletes when they look back and reflect.
- Address other aspects of the Wellness Questionnaire. This can be done by making a booklet to cover all aspects or by spreading the (most difficult) aspects over several sessions.

Guidance

- A junior athlete needed more guidance when completing the tasks in the Step 2 booklet. Therefore, help from an older athlete in the team or by having an additional session with all new junior athletes to give them more time to complete the tasks.
- It's important to discuss the answers of the athletes with the coach during an individual reflection moment to check the answers on general and repetitive statements.
- Provide help to coaches to guide them in analyzing the data of athletes and to support them in the next actions when observing differences in data.

Future technology

- Digitalization of the results of the workshop session, to making it easier for athletes to look back, adjust or change insights or store the booklet more easily. It is not yet possible in the application.
- The 'Mental Readiness' scale ranges from 1 to 10. Future improvements may be to use words or emoticons instead of numbers to fit into the proper measurement of this type of scale.

Future of AMS
In order to increase user engagement with the monitoring systems, the following aspects should be considered in the development process:

- More research should be carried out into the added value of a future dashboard in terms of what the athletes would like to see and why it should be implemented. In addition, the health Questionnaire does not encourage athletes to complete it on a daily basis.
- From the research of Bos, R., & Bekkering, A. (2019), periodization of the execution of a Questionnaire is important to keep increasing compliance in self-reflection and to increase motivation for athletes. Research should investigate whether there are some periods where it's really valuable and necessary and some periods that can be seen as rest.
- A lot of junior athletes feel the pressure to prove that they are at their best in the KTTs and it would be interesting if athletes could tell coaches that they don't have to be at their best every day, hopefully reducing that experienced pressure.

6.1.3 Long-Term and Future Implementation

Long-term implementation
In Chapter 5, the final objective stated the long-term implementation of the final design of improvement in self-reporting and reflection. This could be done by adding the reflective model of Gibb's reflective cycle, which consists of six stages, found in 2.2.2. The six stages will be linked to the reflection process:

- Action plan & description: three times a year, making a new template of step 2.
- Feeling & Evaluation: Reflecting daily on the status of your Mental Readiness.
- Analysis & Conclusion: Every month write down "What have I learned and what do I take with me to next month" providing a new template.

It may be beneficial to use more action plans than three times a year, but more research should confirm this.

In addition to the last objective, the long-term added value of Step 2 in the workshop session should be evaluated later in the season, when the young athletes have more experience in reflection.

Contribution to the (other) sector(s)
The final design is based on the literature of Kellmann (2010) in section 2.2.2 to measure the risk of over- and undertraining using a Wellness Questionnaire. This Questionnaire currently suffers from a lack of data input by the athletes and miscommunication between coach and athlete about the inconsistent data derived from it, as discussed in section 2.2.3.

The final design is a new intervention in the Speed Skating Federation to put the science of literature into practice. By using the Wellness Questionnaire as a communication tool between athlete and coach to express how they would like to receive feedback in order to perform training and encourage more personalized training programs.

The research interventions of the NOC*NSF in recent years have focused on the communication between the coach and the embedded scientist. Therefore, the final design will bring new perspectives to improve the communication between the athlete and the coach for the coming years and will focus on more involvement of the athlete in his own sports career.

The speed skating federation is connected to the NOC*NSF, which means that in the long-term, other federations can use the intervention to improve communication between coaches and athletes. In addition, other sectors such as health care can use the new intervention to communicate about the interpretation of the health scales used.

6.2 Conclusion

The aim of this project is to increase user engagement and motivation for the Athlete Management System (AMS) of athletes within the context of KNSB Talent Teams and to get athletes more involved in their development as top sports athletes. The aim of the project is stated as follows:

"The aim is to increase user engagement & motivation for the Athlete Management System by designing how the reflection process should work for junior athletes and their coaches when evaluating health conditions. The goal is to have a more complete and valuable data set to improve the performance and development of top athletes and prevent injuries or overtraining."

To achieve the project aim, research activities were conducted by the designer such as literature review, observations, and interviews with experts and the target group. The literature review and observations started by understanding the role of AMS as a monitoring system in the context of the KNSB Talent Teams (KTTs) and how other monitoring systems were connected. Research on success and failures in an increase of compliance in self-monitoring were discussed, and more literature review was done on the topic of measuring the recovery-stress state of an athlete, and how the reflective capability of athletes can be stimulated. Eight interview sessions are executed on how the target group reflects on sport progression and how feedback is processed within a KTT. The target groups are in this case athletes, coaches, and embedded scientists of the KTTs. AMS is used to assess the recovery-stress state of an athlete in a digital Questionnaire, and currently, five aspects are evaluated to measure the overall health status: Physical Readiness, Mental Readiness, Emotional State, Motivation, and Muscle Soreness.

Athletes and coaches have the most difficulty in interpreting and assessing the mental health aspect called 'Mental Readiness'. This aspect of mental health is measured using a 1-10 Likert scale in a digital Questionnaire and can be described as a measure of the athlete's ability to concentrate on the execution of a training session.

The results of the research activities were translated into design opportunities, of which one was chosen by evaluating them on viability and impact regarding the project aim by the designer. The chosen design opportunity is to improve communication between athletes and their coaches, and their behavior towards AMS. The opportunity is transformed into a design goal, which is stated as follows:

*The design goal is to design a tool that will **improve communication** and give more **guidance** between talented athletes of the KNSB, aged between 16-22, and their coaches...*

*...in **an explorative way** on how athletes **perceive information & confirmation** how and why the athlete management system is used...*

*...when **reflecting** regularly on the **mental health status** of athletes which can be confronting and therefore make it more discussable and normalized in the long run.*

The final design exists out of two aspects. A Kick-off Workshop and a roadmap, were developed through brainstorming and concept validation sessions.

The Kick-off Workshop is an addition to the current Kick-off meeting, adding an extra workshop besides the general presentation. This workshop contains a presentation with three assignments to let athletes and their coach communicate their interpretations of the 'Mental Readiness' scale and give the first steps in guidance on how to reflect as an athlete on this scale.

The roadmap divides the speed skating season into three phases: introduction, progression, and reflection, and presents the long-term implementation of the Kick-off Workshop in the context of the speed skating season. Furthermore, other presentations and workshops are suggested to increase communication & behavior around AMS in the other two phases of the season.

In conclusion, the design goal has been achieved by assessing the final design with athletes and coaches in evaluation sessions. It only remains uncertain whether the results will increase user engagement and motivation in the long term for the target group, as two factors also influence this process. The first factor is the reflective capability of the athlete and help should be offered to grow in this capability of an athlete. The second factor is the correct interpretation and actions of the staff in KNSB talent teams when receiving mental health data. However, the athletes and coach highlighted the desirability of the Workshop tool by expressing the added value to evaluate the other aspects of the Questionnaire as well during the season.

Assessing the final design on criteria such as desirability, feasibility, and viability are more elaborated in the next section. Recommendations, long-term, and future implementations should be considered in the further development of the final design. Overall, this project has provided a new way of communicating self-reflection for future projects on this topic.

6.2.1. Desirability, Viability & Feasibility

Considering Desirability, Viability & Feasibility in the evaluation of the design proposal will help to assess the effectiveness of the final design. Therefore, a brief summary of the three elements is given below in terms of their effectiveness in this project and beyond.

Desirability refers to how much people want the product and whether it meets their needs and wants (IDEO, (n.d.)). The final design provides more clarity in the communication between coach and athlete on 'Mental Readiness', as can be seen in the results of the 'Deliver' chapter. Athletes know better what to do when they need to reflect on their 'Mental Readiness' status and what they can expect from the coach when the data is analyzed. The coach also has a better idea of how to look at the results of the data and how to give feedback on the training to his athletes.

Athletes and the coach emphasized the high desirability of the workshop tool by expressing the added value of evaluating the other aspects of the Questionnaire during the season. This reflects the need for better communication of the monitoring systems used by KTTs, as stated in the design goal based on interviews and observations during the research phase of the project. The final design is the first step towards a better communication tool and will bring new perspectives to improve the communication between the athlete and the coach for the coming years in the research innovations of the NOC*NSF.

In addition, other sports federations or sectors such as health care can use the final design to improve communication about the correct interpretation of scales used in these sectors to avoid misunderstandings and their consequences.

Feasibility refers to whether it is technically possible to create the product (IDEO, (n.d.)). The final design consists of a presentation, paper templates, and booklets in steps 1 & 2, including tinkering material, which is already feasible with current technology. In step 3, the implementation of the newly added subline in the digital Questionnaire was possible mentioned by the NOC*NSF expert in the Develop chapter.

The feasibility of uploading a photo of the results of the workshop session in the AMS application is currently only possible by the NOC*NSF expert. Possibilities for future implementation of this feature should be explored and discussed between the company of the AMS application and the NOC*NSF. In addition, the possibility of adding the photo directly to the digital Questionnaire should be explored to make it easier for the athlete to review and reflect. However, the time required by NOC*NSF to implement customized Questionnaires should be taken into account.

The need to digitize the results of the athletes' workshop session makes the final design not yet very feasible to easily reflect, change or add insights during the speed skating season.

Viability refers to whether the product is financially sustainable (IDEO, (n.d.)). The final design is viable in terms of low printing costs and the ability to modify the Wellness Questionnaire within a day. However, the roadmap suggestion workshops and presentations are time-consuming, which is limited in KTTs, and cost money. Therefore, the viability of implementing all the suggested workshops and presentations is not yet high. More research should investigate the desirability of the suggested workshops and presentations.

However, the focus on improving communication about the Wellness Questionnaire will help the KTTs to analyze the results in a more efficient and valuable way through consistent data input. Therefore, in order to make the final design desirable and financially viable in the long term, further development should focus on being more in line with the digitalisation project of the NOC*NSF, started in 2019 on Digitalization of Topsport (Voortgang Programma Digitalisering Topsport - NOCNSF, z.d.).

If the digital translation of the results of the workshop is feasible, it will be easier for athletes to reflect, change, and add insights to the application, and will increase the desirability of using the Wellness Questionnaire as a new way of communicating with the coach.

6.3 Personal Reflection

In the last six months I have learnt a lot about the company, the world of top sport and the sport I am most passionate about, which has been a **personal learning ambition.** I have learnt a lot about the tools and methods embedded scientists use in their daily lives and how they work in practice, and I have enjoyed working with people who are passionate about what they do. Looking back at my learning objectives, I can say that I have grown in all of them and I hope to gain more experience in the sports sector in the future.

The **challenges** during the project led to a lot of stress to get everything done in the given time. Therefore, planning was key and I learnt a lot about managing a graduation project involving all stakeholders. One challenge was getting used to the working culture of top sports teams, where schedules change every week and you have to find a place to do your interviews. There was also limited time to speak to the target group, forcing me to plan ahead without knowing exactly how the interview would go. However, having the guidance of my company mentor to steer me in the right direction helped me with the initial preparations and plans could easily be adapted to the context.

As a designer, I enjoyed the part of the project where I could observe how people reacted to the (newly created) interactions between participants and my final design. I enjoyed doing research to delve deeper into the problem area. Throughout my studies I always struggled with the steps in the design process to move from my findings to a concept idea. But since my graduation project, I have found a way to make my own insecurities less of a factor.
Apart from that, everyone is an expert in their own field. So you need the target group to see the added value of your design in context, or you need designers to sparkle your ideas, and I can't live in a world without them.

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Appendix A - Project Brief

DESIGN FOR our future

TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	van der Laan	IDE master(s)	IPD ☐ Dfl ✓ SPD ☐
Initials		2nd non-IDE master	
Given name	Sophia	Individual programme (date of approval)	
Student number		Medisign	☐
		HPM	☐

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Jos Kraal	dept./section	AED
mentor	Pieter Jan Stappers	dept./section	DCC
2nd mentor	Berber Bergsma		
client:	Innovatielab Thialf		
city:	Heerenveen	country:	Netherlands
optional comments	I would like to add Eline van de Kruk as an advisor. She is an assistant professor from the BME department of TU Delft and spent four years doing doctoral research for the national speed skating teams. She has a lot of knowledge about future technological innovations in this sector		

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in by the Chair of the supervisory team

Sign for approval (Chair)

Name Jos Kraal Date 17 Jan 2024 Signature Jos Kraal

CHECK ON STUDY PROGRESS

To be filled in by SSC E&SA (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total	EC
Of which, taking conditional requirements into account, can be part of the exam programme	EC

★	YES	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Robin den Braber Digitaal ondertekend door Robin den Braber Datum: 2024.01.31 09:14:09 +01'00'

Name Robin den Braber Date 31 jan 2024 Signature

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is ...

★	ALLOWED to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Monique von Morgen Digitally signed by Monique von Morgen Date: 2024.01.31 11:06:29 +01'00'

Name Monique von Morgen Date 31 Jan 2024 Signature

DESIGN FOR our future

TUDelft

Personal Project Brief – IDE Master Graduation Project

Name student Sophia van der Laan **Student number** 4,676,904

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Design an engaging athlete-dashboard in the athlete management system SmartaBase for talented speed skating athletes

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

The Netherlands is known worldwide for our innovations in the sport of speedskating [1]. The sport is centred in Heerenveen, where Innovatielab Thialf improves the performance of the sport by making it measurable, interactive and more accessible working together with corporates, governments and universities (Innovatielab Thialf, n.d.). This project is in collaboration with Innovatielab Thialf. The target group are mainly the talent teams of the KNSB, who are referred as athletes in this project brief. The embedded scientists are the heart of the innovation lab. They provide personal feedback to athletes and assist coaches in improving training programs.

Within the KNSB, SmartaBase is used as an athlete management system. This system is used to monitor athletes subjectively and objectively on short time or long time progress. The system is, for example, used to log daily questionnaires for the athletes, but also to store race times or test results. Not all medical information is shared with every team expert. Currently, the system is mainly used by coaches and their staff to evaluate their program, however, athletes start using the system more and more as well. The way athletes use this system is evaluated every year and out of these evaluations came that athletes would like to have a more athlete-specific dashboard to be able to gain more insights into their own progress as well. Because of that, the intention is to build an athlete specific dashboard (Bergsma, B., personal communication, 2023). *Sources: [1] Bull, A. (2023, 5 maart). Champagne on Ice: The mystery and myths behind Dutch skating success. the Guardian. https://www.theguardian.com/sport/blog/2018/feb/13 [2] Innovatielab Thialf (n.d.).https://innovatielab.thialf Sources 1. Kellmann, M., & Kölling, S. (2019). Recovery and stress in sport: a manual for testing and assessment. 2.Kellmann M. (2010) Preventing overtraining in athletes in high-intensity sports and stress/recovery monitoring https://pubmed.ncbi.nlm.nih.gov/20840567/.*

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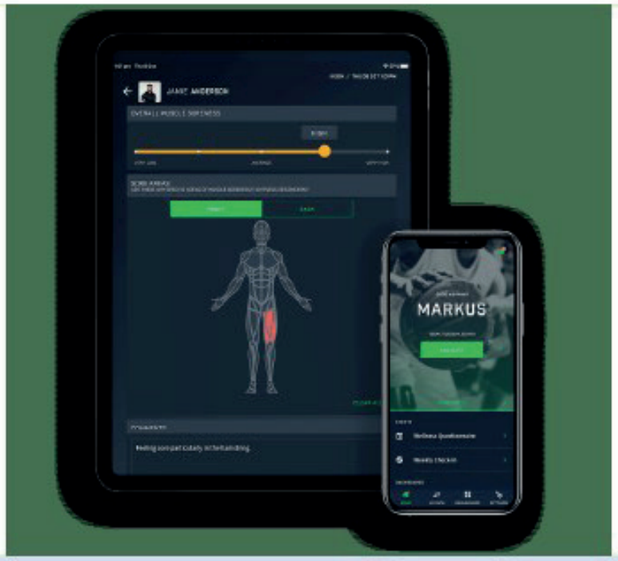


image / figure 1 Screenshot of the SmartaBase application

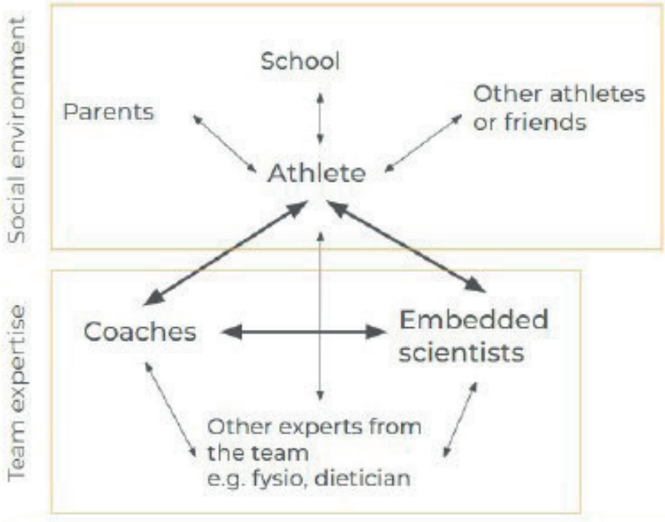


image / figure 2 Stakeholder map

DESIGN FOR our future

TUDelft

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

SmartaBase is, in the beginning of using the system, primarily build for coaches and other staff members to get insight in athlete monitoring. The KNSB is facilitating this for several years and has, together with the NOCNSF, build already quite a good working system for coaches and other staff members. In the system, there is also an dashboard where athletes can get insight in their data as well. In evaluation of the system, however, the athletes pointed out that they would like to have more insights in their own progress via de SmartaBase-app. Usually, embedded scientists together specialists from NOCNSF build these kind of dashboards. However for this build, the KNSB-embedded scientist are curious about that athletes actually like to see in this dashboard. For the accomplishment of this project, KNSB would like to gain insight in how often and for what athletes and coaches use SmartaBase and what they miss in the dashboard right now. Futhermore, improving the dashboard will increase the user engagement of the athlete for this system. Additionally, a dashboard design should be provided to NOCNSF and KNSB embedded scientist to meet the wishes from especially the athletes. My aim is to increase user engagement with the system by designing how the feedback system ideally should work & how the data should be presented to all stakeholders to evaluate health conditions. Ultimately, to have more complete and valuable data set and improve the performance of the athletes.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Design of an athlete dashboard for the evaluation of the daily health conditions of talented speed skating athletes in the athlete management system called `SmartaBase' in order to increase the engagement of this target group

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

First, to gain more insight in the world of elite athlete sport and the use of SmartaBase in Thialf, I will participate in the set-up of an check-in system using SmartaBase questionnaires in combination with objective measures every morning for two weeks. Furthermore, user research will be conducted by doing stakeholder interviews (including sensitizing booklets), surveys, observations to map the context and the wishes and needs of the stakeholders and the current use of the management system (input & output). Simultaneously, literature research will be conducted on topics of motivation and behavior change models strategies. Both findings in research will give input in creating a stakeholder map, service blueprint and customer journey map to capture the design space and pinpoint the bottlenecks of the current system to state a design goal & sub research questions. There will be interviews with at least 10 athletes and 2 coaches. The focus will be on designing a feedback system e.g. a dashboard and by that to engage athletes in the right way. After defining the design goal, a brainstorm and co-creation session will be conducted to design possible solutions. The most promising designs will be developed and tested in a Lo-Fi prototype with the current target group to test the effects. Evaluation and iteration will take place to produce an initial design for a Hi-Fi prototype.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting, mid-term evaluation meeting, green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	10 jan 2024
Mid-term evaluation	19 mrt 2024
Green light meeting	27 mei 2024
Graduation ceremony	27 juni 2024

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	25
Number of project days per week	4,0

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

Throughout my studies I have been energised by sport and it has always inspired me to learn more about training and techniques to improve myself as a speed skater. In the future I would like to help people improve their human performance in areas such as top sport, rehabilitation centres or the military. Everyone participates in top sport at a different level.

In this graduation project I want to show what I have learned during my studies and how valuable an interaction designer is in any company or project. First, I will conduct user research by interviewing, listening and observing to map the context. I want to test the theory of behaviour change models in practice and make a complex system visually understandable through a service blueprint & customer journey map. I also want to use my knowledge of Figma, laser cutting and 3D printing for creating possible (digital) prototypes and test innovative technologies to measure (mental) health.

A personal learning ambition is to gain a deeper understanding of how the human body works and how to optimise its performance. My Anatomy and Physiology elective provided the foundation for this ambition. I believe that working with embedded scientists can enhance this knowledge and how to put this knowledge into practice. I want to learn from them and the tools they use in the projects they are currently working on.

Appendix B - Interview Questions: Athlete, coach & Embedded scientist

Questions asked in discovery phase interviews. The interview goal is divided into sub interview questions for each target group.

Sub interview questions for the athlete test are the following:
- How do athletes now reflect on their performance and what is the ideal?
- What data would they like to see as feedback on their performance?
- Who or what motivates them to be top sport athletes?

Sub interview questions for the coach test are the following:
- What type of tools or data do coaches reflect now and how is the feedback of those reflections given to the athlete? Which monitoring system plays a major role in this?
- How do they ideally see the feedback to the athlete and what tools/help of experts/data do they need for this?
- How do the coaches experience the ratio: 1 coach and many athletes? Does this make them look at data differently

Sub interview questions for the embedded scientist are the following:
- What type of tools or data is valuable for embedded scientist to reflect now on sport progression of athletes and how is the feedback of those insights given to coaches or athletes?
- What type of change would you see in an ideal situation?

Planning - Test session & questions
Introduction: 3 minutes
Main part (see details below): 10 minutes
Closure: 2 minutes

Main part athletes:
Hoofdvraag: Hoe reflecteer jij op je sport progressie en wat helpt daarbij?
Aandachtspunten: reflecteren = hoe werk jij aan.. progressie = vooruitgang/doelen/eigen ontwikkeling
Reflecteren op sportprestaties
- Welke tools/hulpmiddelen gebruik je.
- Waarom/hoe reflecteer jij op je prestaties.
- Hoe kijk je hierop terug (Feedback)
- Wat zou het beter maken om te reflecteren. Wat mis je nu als het gaat op de evaluatie van je proces?
- Wat doet smartabase voor jou (waar kijken ze naar, snappen ze de termen).
- Op welk moment kijk je nu hierop terug, is dat ideaal? Op welk moment wil je dit bespreken? (blessures, ziek, topvorm, trainingskamp, wedstrijddag of rustdag)
- Heb jij een beeld over hoe fit je bent (conditie) en waar je naartoe werkt als topsportatleet?
- Hou hou je dit bij? Naar welke aspecten kijk je?
- Hoe weet jij hoe je je voelt op een dag en kan aanvoelen of je deze dag meer of minder aankan in b.v. trainingen of school?
- Hoe ga je hiermee om? hou je dit bij? Lekker in je fel zitten.
- Hoe ga jij om met stress/druk en hou je dit bij/reflecteer?
- Verhouding training/rust/school

Feedback op sportprestaties
- Wie zijn de belangrijkste personen.
- Met wie bespreek jij deze resultaten of je ontwikkeling? Is dat altijd dezelfde persoon?
- Op welk moment bespreek je dit nu en is dit voor jou ideaal? Op welk moment wil je dit bespreken (Evaluatiegesprekken)
- Met wie zou je dit het liefste willen bespreken?

Dynamiek van team
- Hoe helpen je teamgenoten in het beter worden van de reflectie op je progressie?
- Wat bespreken jullie? Hoe is de groepssfeer? Is leeftijdsverschil merkbaar?

Overige vragen
- Hoe belangrijk is het voor jou om hier te zijn als topsporter. Waarom zit jij in het KTT?
- Wat of wie motiveert je om hier naartoe te komen? Lukt dat elke dag?
- Wat werkt nu niet in reflecteren voor jou?
- Wat zou je nieuwe atleten mee willen geven? (senior)

Main part coaches
Hoofdvraag: Hoe reflecteer jij met de atleet op zijn/haar progressie en wat helpt daarbij?
Hoe monitoor je een hele groep atleten en wat helpt daarbij?
Aandachtspunten:
Reflecteren op sportprogressie
- Tools/hulpmiddelen
- Hoe reflecteren ze? Hoe geven ze feedback? Excel of smartabase of coach-in control?
- Waardevolle gegevens als coach (in Smartabase?) voor reflectie en training.
- Is de data begrijpbaar? Of is het stukje gevoel/ervaring?
- Waar kijken ze naar, snappen ze de termen?
- Waarom leeft smartabase wel of niet voor jou?
- Wanneer zou je het liefste in willen zetten. Periodisering? Extra opleiding?
- Op welk moment /wanneer kijk je nu hierop terug, is dat ideaal? Frequentie
- Zien jullie als atleten iets uploaden?

Progressie in resultaten
- Heb je een beeld over hoe fit je atleten zijn en waar ze naartoe werken als topsportatleet? Hoe hou je dit bij? Overtraining vs blessures?
- Hoe weet jij hoe je atleten zich voelen op een dag met wat ze aankunnen?
- Welke informatie is belangrijk om voor of na de training terug te koppelen naar de atleet? Zeg je ook wel eens iets niet?
- Hoe koppel je dit terug?

Feedback op sportprestaties
- Terugkoppeling atleet
- Hoe wordt de data teruggekoppeld naar de atleet?
- Wat vind je van deze manier? Wat zijn jouw taken in het vertalen? Hoeveel tijd/moeite kost dit? Zou het altijd zo moeten gaan?
- Hoe/waarom belangrijk is de terugkoppeling naar de atleet voor jou?
- Op welk moment wordt dit teruggekoppeld?
- Assymetrische verhouding coach vs atleten
- Hoe ga je om met veel data van atleten en weinig tijd?
- Verhouding werk vs aantal atleten
- Presentatie van data
- Zijn evaluatiegesprekken hierdoor individueel of juist in groepsverband? Zou je dit anders willen zien? Frequentie? Meer tijd voor nodig?
- Welke gegevens gebruik je als evaluatiegesprek stof?

Begeleiding/experts
- Verhouding team
- Wie zijn de belangrijkste personen
- Met wie bespreek jij de resultaten van atleten? Met wie zou je dit het liefste willen bespreken? Fysieke en mentale data

- Op welk moment bespreek je dit? is dit voor jou ideaal? (1x in de week, elke maand, voor een wedstrijd?) Teambesprekingen
- Begeleiding in mentale stukje ipv fysiek
- Hoe voel je je erbij als je zulke data binnen krijgen. Doen jullie daar iets mee?
- Hebben jullie hier hulp/begeleiding in? Zijn jullie daarvoor opgeleidt?
- Kunnen atleten er makkelijk met jou over praten? Verwijs je atleten vaak door?

Extra vragen

- Overige vragen
- Wat werkt nu niet in reflecteren voor jou?
- Waar wil je nog verder opgeleidt in worden/willen leren?
- Hebben jullie een cusus gedaan voor omgaan met mentale begeleiding?
- Zomerperiode
- Hoe waarborg je het teamgevoel in de zomer?
- Hoe ga je om met de data van de zomer ivm de winter?
- Wordt in de zomer de wellness/rpe anders ingevuld dan in de winter?
- Ideaal scenario
- Waarom doe je het op deze manier en waarom doen we het niet op een andere manier?
- Wat zou het beter maken om te reflecteren? Wat mis je nu als het gaat op de evaluatie van je proces?

Main part Embedded scientist

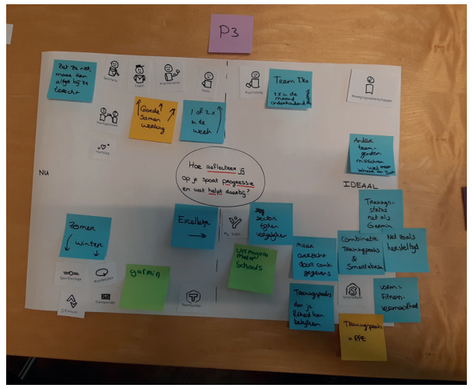
Hoofdvraag: Hoe reflecteer jij op de sportprogressie van een atleet?

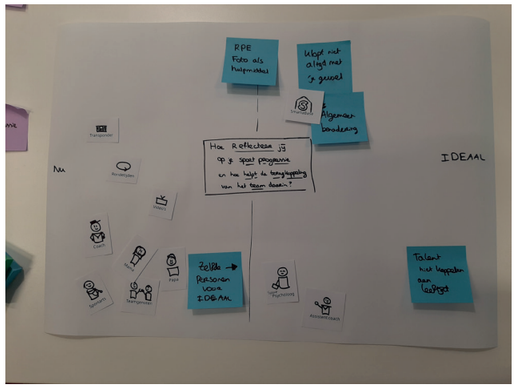
Aandachtspunten:

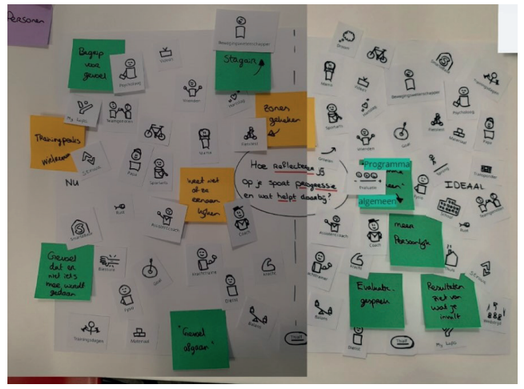
- Welke monitoringssystemen gebruik jij naast smartabase als BW voor het reflecteren op prestaties van atleten?
- Wat zie jij als monitoringssystemen? Welke gebruik je het meeste? (icons tools)
- Wat zijn voor jouw waardevolle gegevens waar je naar kijkt (in smartabase) als BW? (icons data)
- Met welke vragen komen atleten of coaches naar je toe over het monitoren?
- Hoe koppel je resultaten of data terug naar de coaches of atleten? (icons terugkoppeling)
- Met wie bespreken? (icons wie)
- Nu of ideaal gezien? Welke verandering zou je graag anders zien?

Appendix C - Results toolkit of context mapping

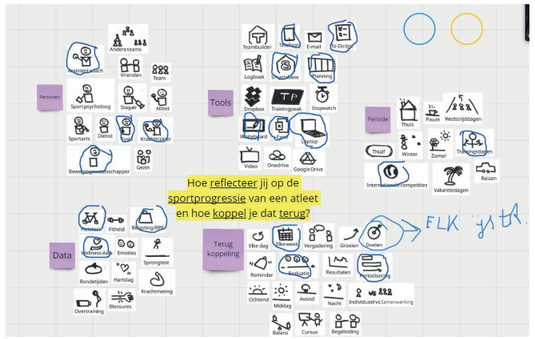
Athletes

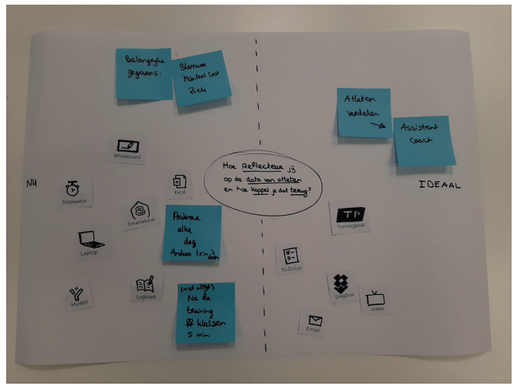


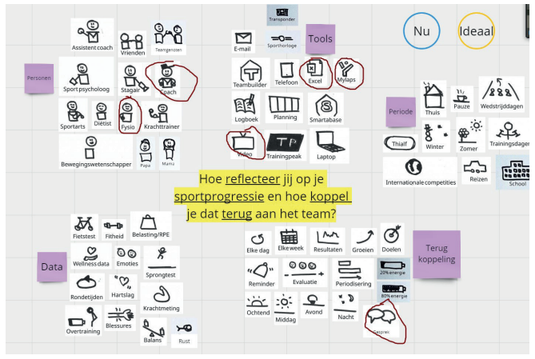




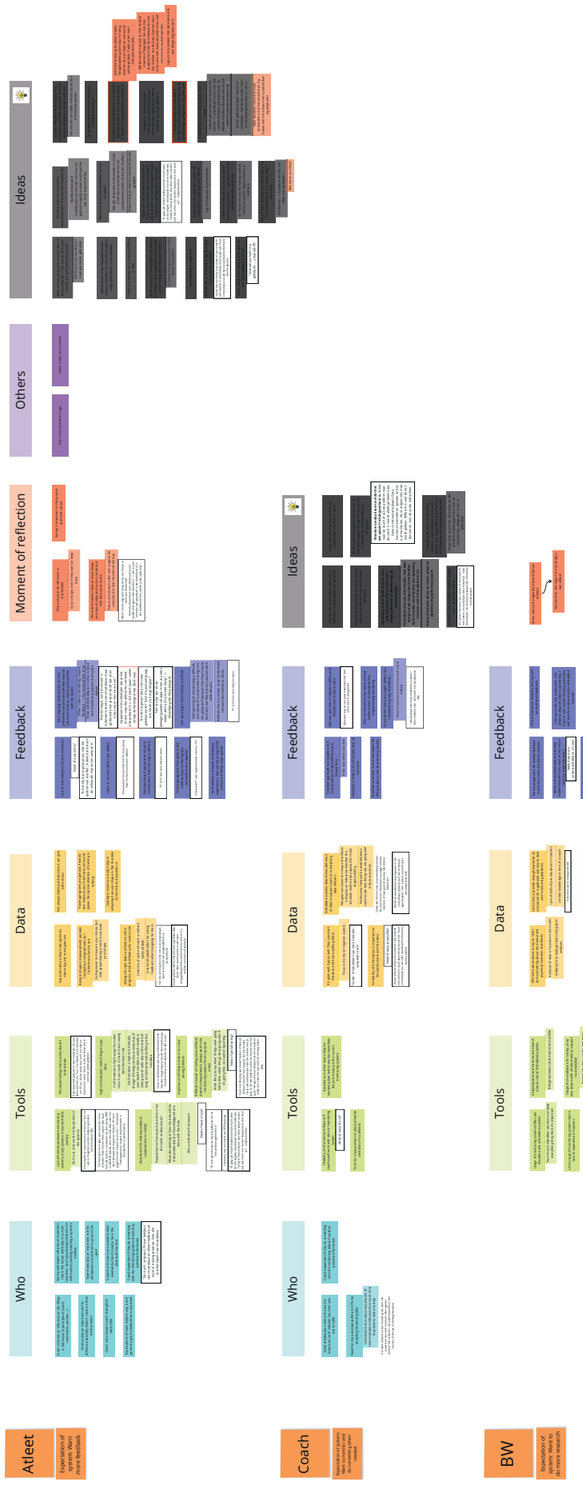
Coaches & embedded scientist







Appendix D - Clustering categories in MIRO



Appendix E - Numerical ranking of design oppportunities

Monitoring system

1: Use the strength of each monitoring platform used by athletes & create more coherence between those strengths
2: Use the strength of functionality of each monitoring system for analysing data by coaches as extra recourse besides own capabilities
3: Stimulate the athletes with the appropriate motivation & show appreciation for filling in SRSS & RPE forms
Coach must take an active position in this
4: Acceptance of confrontation or make the confrontation less present when athletes are analysing their health status every day
5: Lower the threshold for athletes to be able to analyse their data at the right moment to see how the load is applied and talk to experts when needed
6: Make self-reporting of stimulation of extra training or reporting overtraining/pressure of external resources easier for athletes to coaches so professional help is used when needed
7: Make consequences less impactful when filling in tests (it's okay to not to be okay)

Communication between athlete & coach

8: Athletes want to have more confirmation & involvement in the results of what the staff does with the information they are given in the forms to make relevance clear to athlete to check-in using the platforms
9: Discuss with athletes how the SRSS & RPE test should be used & how data analysis work by coaches & talk with athletes if data is mismatching/inconsistent

Coach expertise

10: Get support in how to use monitoring systems & analyse data as easy as possible
Support in interpretation of data
Support in efficient data analysis

Role of embedded scientist

11: Get support of providing enough expertise to coaches & athletes of data collected by monitoring systems

Appendix F - Brainstorming plan

Goal:

- As many ideas as possible for the design direction.
- Which direction has the most impact?

By

- Role play of the scenario in which the athlete comes into contact with the platform with How To's in between for brainstorming

Preparation:

All the participants were given a question beforehand on how they would measure their own health by means of applications (mental & physical). In addition, a short introduction was given on what it takes to be a top sports athlete in order to get into the role of the target group, at least one day in advance.

Participants

- 1 facilitator
- 1 IDE master students
- 2 Alumni of IDE masters

Set-up

Physical meeting, using big sheets of paper and Post-its to write ideas on. Walk through the scenario using a laptop

Program

Total time: 2 hours

Introduction

- Rules of brainstorming
- Goal of the day
- Explain the scenario
- How to's in between

Scenario: In between How To's are asked

First How To - Icebreaker

- Purge on empty sheet on the question asked beforehand: How to... measure your health in other ways?

The second wave of How To's

How to... (Application)

- ... ensure that the user knows what is expected of him or her when using an application?
- ... communicate the use of the forms in advance?
- ... to fill something in less consciously/confrontational?

How to.. (Feedback)

- ... give information and confirm how and why the platform is used.
- ... clarify the relevance or importance of the platform.
- ... show how coaches' feedback process works?
- ... increase the feeling that the staff looks at the data.
- ... increase knowledge of how coaches & athletes should use the tests.
- ... increase the knowledge of athletes on how data analysis works.
- ... improve the feedback that athletes receive.
- ... keep the autonomy of what data is shared with staff?
- ... support athletes' confidence?
- ... stimulate more training?
- ... show overview of results

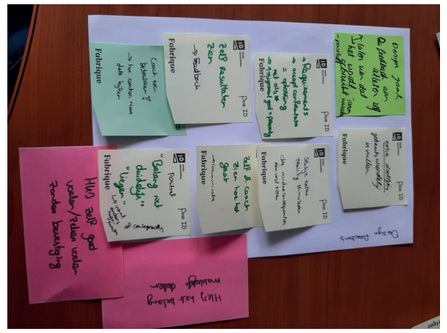
Energizer

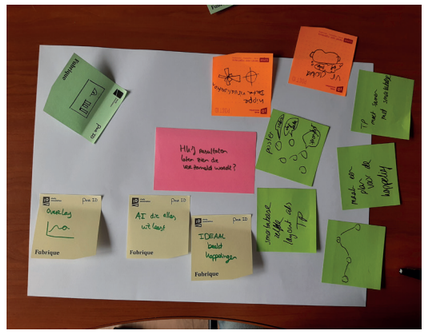
Review ideas with the group

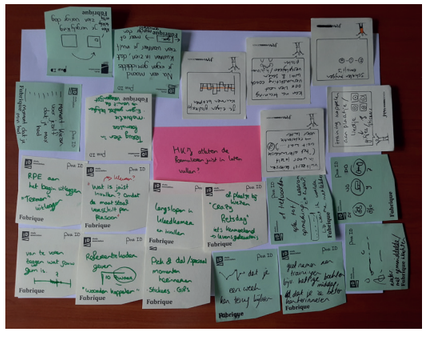
Hits & Dots

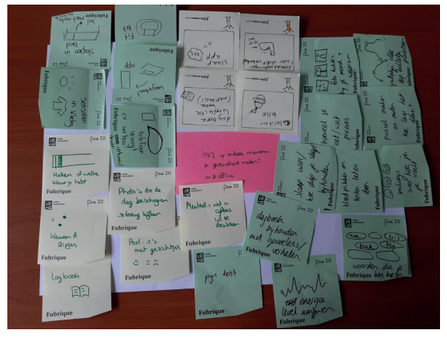
All participants choose together the most promising ideas

Appendix G - Results of How-Tos









Appendix H - Roadmap

Roadmap of season talented athlete
Addition to current year schedule (2023-2024)

Roadmap is based on findings in graduation report of Sophia van der Laan

The Roadmap is divided in three time periods, called horizons: Introduction, Progression & Reflection, connected to a season of a talented speed skater. It summarises athletes wishes and needs for information needed on monitoring systems for long-term use.

All elements listed in this visual are new or contain new elements in the annual plan

*POP = (Read: Personal training program)

Research outcomes:
Athletes reported that they find the health scales in the Wellness Questionnaire confronting, don't understand the scales or not resonate with their expectations of measuring health. Research indicates that there is often miscommunication between the coach and athlete regarding the use of these scales.*

*References: Brink, M.S. et al, 2017; Kerkhoff, M., et al. 2022

Suggestions for improvement
Therefore, extra information is provided in a presentation and a workshop session for athletes to get familiar with the health scales used in the Wellness Questionnaire and develop their own frame of reference.

Multiple times a year
Goals and skills are developing and dynamic, just like the reflective capability of athletes on their health condition.

Include the workshop about defining a frame of reference for the mental health scales in the Wellness Questionnaire at least three times a year. Boost confidence in self-reflection to sit one time a month with an expert to teach about self-reflection (e.g. lifestyle coach)

Examples of visual styles for illustrations made by storyset

Currently, the presenation is given by the embedded scienist. Coaches play an important role in the motivation of athletes, therefore, switching the roles in presentor would contribute to showing the relevance of monitoring.

Addition to current slides:
- Highlight relevance and importance of monitoring: show what is done and how it is applied in practice to prevent overtraining and stimulate more effective training. Emphasis the team composition of KTTs of one coach and a team of athletes.
- Highlight value for sporter
- Explain subjetive (SRSS/RPE) & objective measurements (CMJ/Wingate). Explain usage of health scale, and trainingsload (how is RPE calculated).
- Highlight the actions of coach when receiving the data: What data is received, and analysed.
- Highlight influence of irregular data & emphasize analyse of individual athlete input
- Add examples of schedules when to use subjective measurements & keep a professional tone in worduse and visual style.

Wellness	Morning
Training	
RPE	After training (30 min)

Example of schedule for subjective measurements

*POP = (Read: Personal training program)

Result of improvement in introduction period

Focusing on providing more clarity in information at the kick-off meeting at the beginning of the season will evolve in less frustration or difficulties in other phases of the season, like the POP-meeting or the first training sessions when the athletes have to use for the first time the AMS application.

POP meetings take place every two weeks between coach and athlete. There is no standard format for these meetings yet. It is important that during these meetings, discussions are held about the frame of reference that the athletes created during the workshop session. Expectations regarding the use of the scales in the Wellness questionnaire can then be established for both sides, which indirect will prevent miscommunication about the health scales.

Talking about the health scales increases confidence for athletes in using the monitoring systems and let them keep the autonomy on how they look at the health scales. It is advisable to add a standard discussion about the frame of reference to the POP meeting after each workshop session.

If the athlete still has difficulty in reflecting on their health conditions after the POP meeting, it may be decided to discuss this again with the embedded scientist in an extra session.

Research outcomes:

Speed skating often focuses on the physical aspect. Two out four junior athletes find it difficult to express pressure and stress to the coach.* This is reflected in the Athlete Management System (AMS) as they tend to lie about their responses on the questionnaires or fear the negative consequences it might bring, such as less training. One senior athlete mentioned that just talking with someone about managing stress or pressure helps in acknowledging it.

Three out of four junior athletes feel that the AMS is not being utilized.

Five out of six athletes (both junior and senior) indicate that they foresee the need for or have encountered the need for a sports psychologist/lifestyle coach.

Two out of four junior athletes want to know more about what the staff does with the results from the wellness and RPE tests.

One senior athlete mentioned that overtraining could have been prevented by talking about it more.

*more information on execution of interviews can be found in report

Suggestions for improvement

Recap of presentation:
- Kick-off meeting about the usage of monitoring systems before the start of wintersaison. E.g. FAQ or other unclarities.

New topics of presentations:
- Introduction of overtraining and prevention: Old professional can talk about experiences of overtraining or topics like it's okay not to be your best every day.
- Introduction to staff members: Role of the staff members in the team
- Additional workshop: how to create a sporters mindset with the lifestyle coach, data analysis (how data works, how it's analysed, and how you can analyse it yourself), Explanation of a good sleeping routine or Readiness to train (RTT).

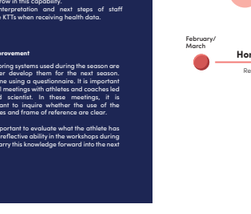
Buddies
- Junior athletes will have a senior buddy to talk to every month for checking in on stress and pressure of being a topsporter.

General knowledge sharing:
- Every 4/6 weeks feedback to coaches is given by embedded scientist on FAQ of data received from AMS to keep the coaches up to date.

Kick-off Workshop

Presentation: Relevance & importance of monitoring
Explanation about importance including what the staff sees when receiving 'Mental Readiness' data.

Step 2: Make a reference framework of the 'Mental Readiness' scale
Athletes have to create their own reference framework of the scale 'Mental Readiness' to get a better understanding how the athlete should reflect on this scale.



Step 1: Definition of Mental Readiness
Associations of athletes and coach among the 'Mental Readiness' term are clustered on a template to see if they are on the same page when athletes measure or coaches review 'Mental Readiness' data.

Step 3: Where to find Steps 1 & 2 in AMS
Step 1 & 2 will be stored digitally in AMS so the athlete can look back when they need to reflect on their 'Mental Readiness'.

Research outcomes for long-term implementation

An expert in sport psychology mentioned that two important steps influence the motivation in the long-term process of usage of a monitoring system.
1. The reflective capability of an athlete, where help should be offered to grow in this capability.
2. The correct interpretation and next steps of staff members in the KTTs when receiving health data.

Suggestions for improvement

Annually, the monitoring systems used during the season are evaluated to further develop them for the next season. Currently, this is done using a questionnaire. It is important to schedule physical meetings with athletes and coaches led by the embedded scientist. In these meetings, it is particularly important to inquire whether the use of the health questionnaires and frame of reference are clear.

Additionally, it is important to evaluate what the athlete has learned about their reflective ability in the workshops during the season and to carry this knowledge forward into the next season.

Appendix I - Test plan concept validation

Concept validation

Goal of the sessions:

- Get as much input & valuable feedback on my concepts for further improvement
- Get insights on what will work out in the context of the target group

Concept part validation:

Roadmap: Bewegingswetenschappers & coaches
Goal: Validate the roadmap & important moments in the timeline
Details of kick-off presentation & reference framework: athletes & coaches, BW
Goal: Validate information of kick-off presentation & framework

Participants:

Week 20 - pilot
Session 1: Roadmap & Kick-off Workshop
Target group: TU Delft (top)sporters/IDE students

Week 21
Session 2: Recommendations for kick-off Workshop
Target group: Embedded scientist

Session 3: Recommendation Roadmap:
Pas het bij de huidige aanpak/wat wordt er al gedaan?
Target group: Embedded scientists

Session 4: Recommendation Roadmap:
Past het bij de herziende jaarplanning
Target group: Embedded scientist

Session 5: Kick-off Workshop - template step 2
Target group: Sports psychologist

Session 6: Kick-off Workshop
Target group: Senior athletes + junior athletes

Session 7: Kick-off Workshop
Target group: Coach

Week 23
Session 8: Technological possibilities
Target group: NOC*NSF expert

Appendix J - Validation Questions: concept - target group

Vragen voor coach

Introductie: 2 min

Icebreaker: 3 min
Wat versta jij onder mentaal readiness (ook wel mentale gesteldheid)

Scenario 1: 5 min
Seizoen is net gestart, atleten kick-off meeting gehad en hebben een extra opdracht gekregen om de schalen die ze gebruiken in de wellness vragenlijst te oefenen en eigen te maken
Opdracht 1:
Geef papier en 3 kleuren om de schaal in te kleuren

- Hoe zie jij voor je dat atleten deze schaal zullen invullen over mentaal readiness invullen voor aankomend seizoen?
- Zou je nog iets willen toevoegen aan de schaal om het beter te onthouden? (b.v. getal 1 tot 10)

Er zijn vlakken kleuren en raakpunten in de kleuren

- Wat merk je aan een atleet in dat gebied? Wat kan je zelf doen als coach voor ze in die status?

Scenario 2: 5 min
De POP-meeting komt eraan na de kick-off meeting en de atleten hebben dezelfde soort schaal ingevuld naar eigen interpretatie
Opdracht 2:
Laat een voorbeeld zien wat de atleet heeft ingevuld

- Er blijkt een verschil te zitten in de schaal die jij zojuist hebt ingetekend en van die van de atleet. Hoe zou je deze verschillen willen bespreken?

*Atleet geeft aan het lastig te vinden om eerlijk te zijn en soms in het rode gebied de vragenlijst in te vullen, aangezien er vaak negatief op wordt gereageerd, zoals b.v. in een lager groepje worden geplaatst

- Wat zou je met de atleet afspreken om dit te voorkomen?/het gevoel te verminderen?

Scenario 3: 5 min
De eerste POP-meeting zit erop en de trainingen staan al op het programma. Je ziet dat een aantal atleten in het rood staan op je dashboard van AMS
Opdracht 3:

- Welke acties zou je ondernemen als je een atleet nu in het rood ziet staan?
- Wat zou je graag willen terug zien in de resultaten om beter te onthouden voor welke atleet je wel of niet in moet grijpen/wat er afgesproken is?

De data kan variëren in hoe het gepresenteerd wordt aan jouw als coach zijnde/laat verschillende opties zien

- Hoe zou je reageren op als een atleetn in het paars staat?
- Hoe zou je erop reageren als de atleet een teken/communiceert dat hij/zij zijn dag niet heeft?

Voortgang/opdracht 4: 5 min

- In hoeverre helpt dit met de communicatie tussen jouw en de atleet over wat hij/zij invult in de wellness vragenlijst? (minder miscommunicatie?)
- Weet je nu beter waar je op meot reageren als je de mentale readiness data binnen krijgt?
- Wat vind je er nu van dat je de mentale gesteldheid schaal nu met de atleet bespreekt? (fijn/niet fijn?/mis je iets?)

Feedback/afsluiter: 5 min

- Was de test te begrijpen of was er iets onduidelijk/moeilijk in te vullen?
- Algemene opmerking over het idee?

Vragen voor atleten

Introductie 5 min:

Concept 15 min

Bespreken begrip: laat definitie zien van mental readiness

- Wat verstaan jullie onder mental readiness (mentale gesteldheid)?

Eigen schaal maken: kleur de vlakken in en schrijf op hoe ze zich voelen bij raakvlakken

- Denk je dat dit idee je had geholpen bij het invullen van de vragenlijst als je dit vooraf had besproken in de kick-off meeting?
- Wat vinden jullie ervan om dit tijdens de kick-off meeting in te vullen? (Liever thuis)
- Stel je laat je eigen schaal na de kick-off meeting zien aan de coach, zou je dan alles durven te laten zien?
- Welk moment na de kick-off meeting zou je dit willen bespreken?
- Hoe zou je de interpretatie van hulp na de kick-off meeting na je coach vertellen?

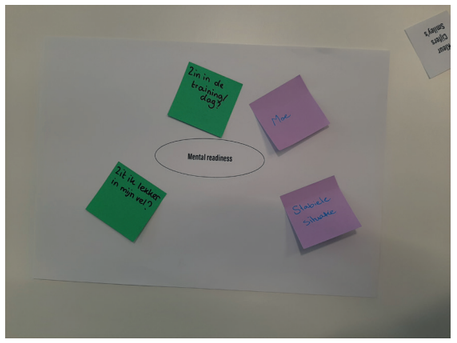
Review 10 min

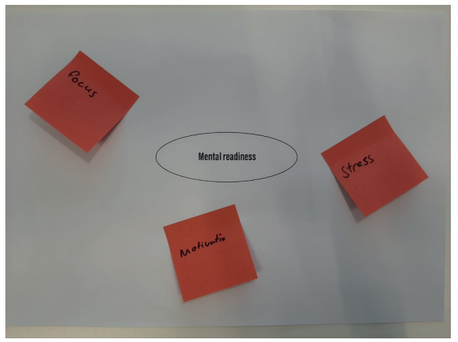
Algemeen

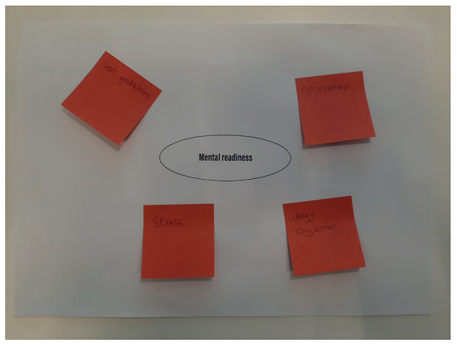
- Je hebt verschillende elementen gebruikt zoals vormen, smileys, kleuren, getallen, anekdotes, dieren wat werkte wel of niet goed voor het begrijpbaar maken van de schalen?
- Fijn om zelf voorbeelden te maken? Lastig om bij op te komen?
- Wat had je graag willen weten bij je eerste kick-off meeting t.o.v. van deze?
- Wat is er verandert met je kennis die je wist t.o.v. de kennis die je hiervoor wist?
- Motiveert het jouw meer om het systeem te gebruiken?
- Denk je dat deze ideeën je hadden geholpen bij het invullen van de vragenlijst als je dit vooraf had besproken in de kick-off meeting?
- Heb je het idee dat je deze ideeën bij een volgende meeting met je coach of met het team er over kan praten?
- In welke vorm zou je het willen bewaren? Digitaal of b.v. in de kleedkamer?
- Zijn er schalen waar je meer duidelijkheid over zou willen?
- Jullie input?

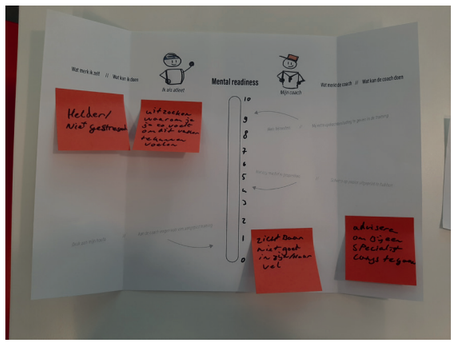
Appendix K - Results of concept validation session Target group

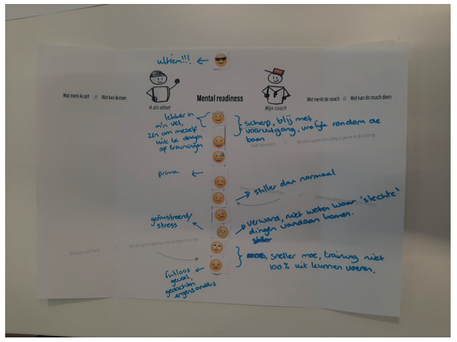
Athletes

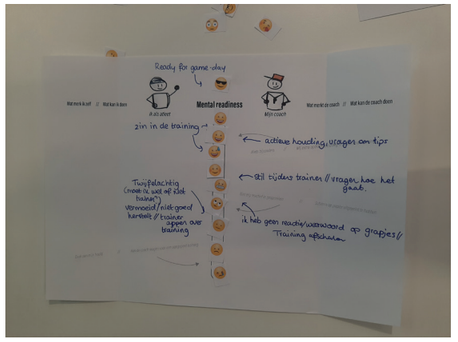






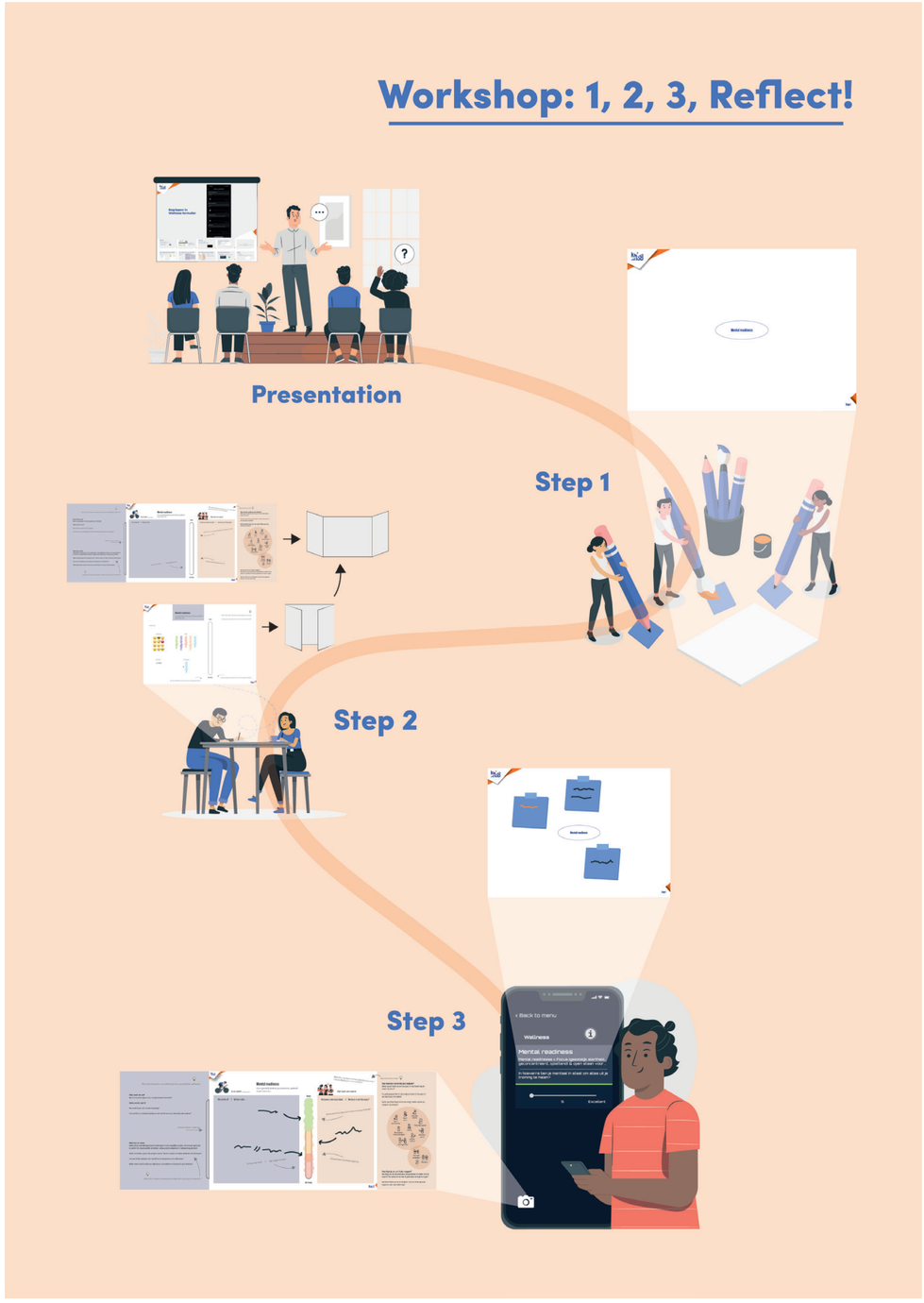




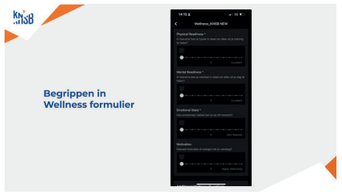


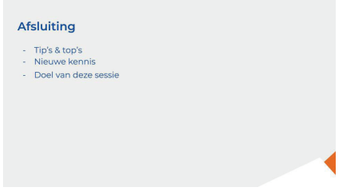
Coach

Appendix L - Steps of Workshop session

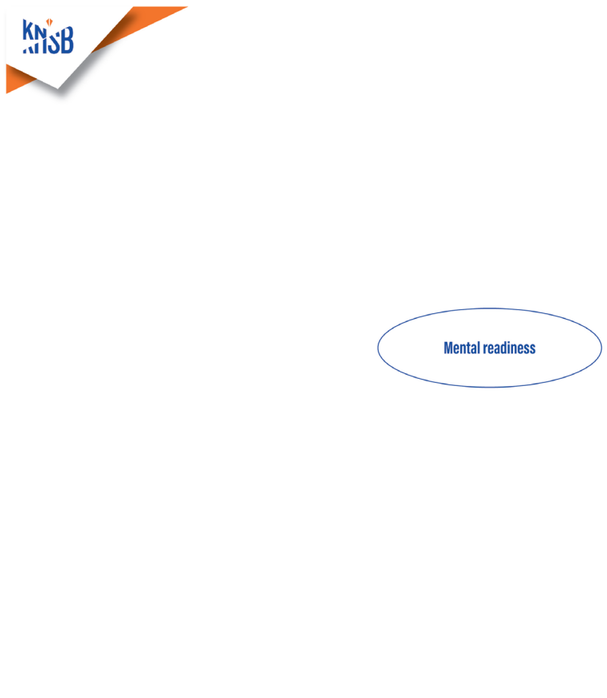


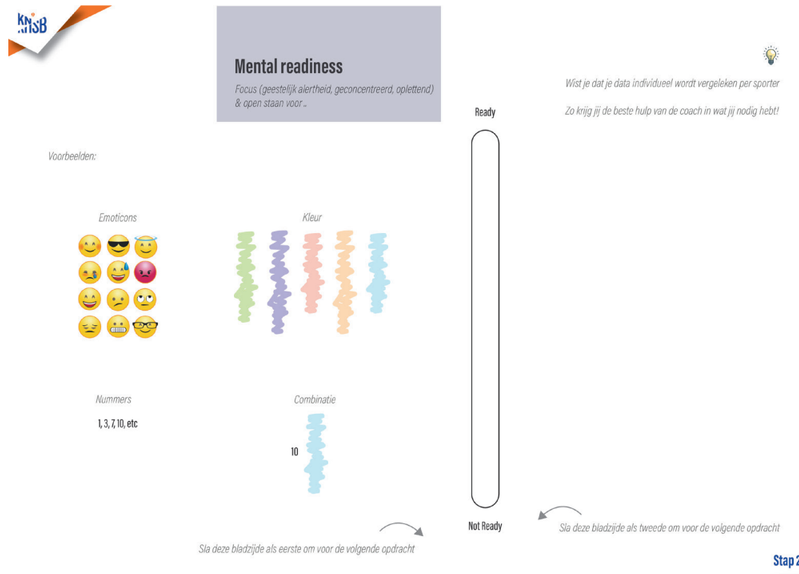
Appendix M - Presentation slides of Workshop session

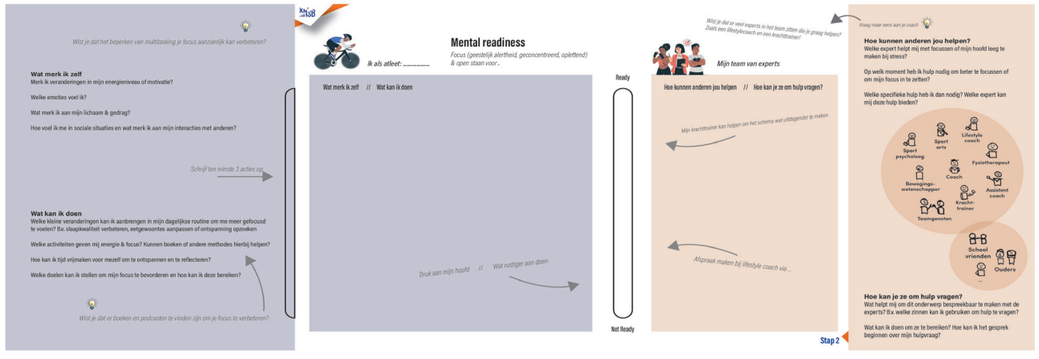




Appendix N - Templates of steps in final design







Appendix O - Validation Questions final evaluation

Planning Kick-off Workshop
9:45-10:00: Introductie embedded scientist & coach
10:00-10:05: Introductie sessie
10:05-10:10: Stap 1: definitie mental readiness
10:10-10:25: Stap 2: Eigen schaal maken van mental readiness
10:25-10:30: Stap 3: Afsluiting
- Schrijf een tip/top op van de stappen 1 & 2
- Stuur foto naar embedded scientist voor het uploaden in AMS & vertel waar het in AMS te zien is.
- Kijk extra goed in AMS deze week, want volgende week een paar interviews

10:35-10:45: Evaluatie van de sessie met coach/embedded scientist
10:45-11:00: Opsturen van definities naar NOC*NSF Expert voor implementatie in AMS

Interview vragen - Groep 1: Coach

- Wat voor vervolgstappen onderneem je als je atleet een hoge of lage mental readiness invult?
- Hoe helpt het begrip die we vorige week hebben besproken (mental readiness) jouw als coach naar je atleten toe in jouw trainingsprogramma ?
- Hoe helpt de schaal die ze vorige week hebben ingevuld met jouw trainingsprogramma?
- Wanneer zou je dit willen inzetten? Bespreken?
- Hoe kan je ze begeleiden bij het invullen van de schaal?

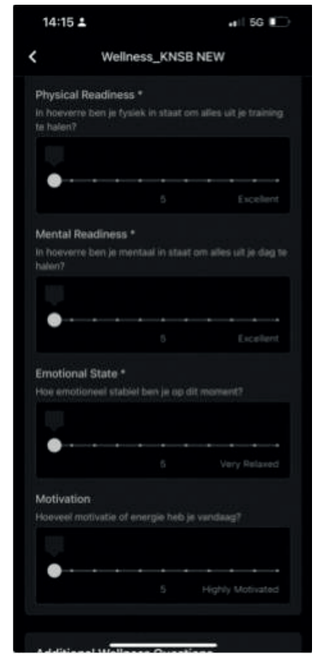
Interview vragen - Groep 1: Atleet
Introductie

Objective 1: Improve guidance when reflecting
Definitie begrippen → mental readiness
- In snap beter wat er van mij verwacht wordt bij het invullen van de term 'mental readiness' na de kick-off meeting (1- helemaal niet mee eens - 5- helemaal mee eens)
- De definitie van het begrip 'mental readiness' die nu bij de vraag staat in de Wellness vragenlijst, helpt mij om beter te kunnen reflecteren op mijn eigen mental readiness status? (1- helemaal niet mee eens - 5- helemaal mee eens) - eigen woorden of officiele definitie?
- Zou je iets willen toevoegen of veranderen aan de definities of de digitale schaal

Schaal → mental readiness
- Hoe vaak heb je terug gekeken naar de schaal die we vorige week hebben gemaakt?
- Lukt het om hem makkelijk terug te vinden?
- Wat denk je dat het doel is van deze schaal?
- Helpt de schaal die je vorige week heb gemaakt jouw om op jezelf beter/accurater te reflecteren (terugkijken) hoe mental ready je bent? Eerste stap in guidance
- Wat doet de schaal voor jou? Belangrijk?
- Zou je dit willen/wanneer gebruiken in aankomend schaatsseizoen?
- Speelt de coach hier een rol in? Of iemand anders van de staff?
- Wat helpt jouw om de schaal in te vullen? Samen of alleen?
- Zou je iets willen toevoegen of veranderen aan de schaal?

Objective 2: Improve communication on information about usage of AMS & confirmation of next steps of coach
Presentatie
- Waarom denk je dat de coach zou willen weten hoe mental ready je bent?
- Wat voor vervolgstappen verwacht je dat de coach zal ondernemen als jij je mental readiness invult? Denk aan de kleuren van vorige week - gebruik bij hoge waardes?
- Welke stappen zou je zelf ondernemen? Bespreekbaar?
- Zou je iets willen toevoegen of veranderen aan de presentatie?

Objective 3: Suggesties voor lange termijn - Overige vragen als er tijd over is
- Zou je voor de andere begrippen ook een eigen schaal willen maken? (motivation, emotional state, RPE, etc). Welke specifiek?
- Hoe zou je het willen bewaren?
- Helpt het bespreken van de schaal bij het meer betrokken raken bij het monitoring process van je eigen ontwikkeling in je top sport carriére?



Interview vragen - Groep 2
Introductie
Doel onderzoek & 10 minuten voor de sessie

Intro vraag
Hoeveelste jaar in dit team?

Stap 1: 5 min
Definities: Physical readiness, Mental readiness, Emotional state, Motivation, Muscle soreness
- In snap beter wat er van mij verwacht wordt bij het invullen van de term 'mental readiness' na de kick-off meeting (1- helemaal niet mee eens - 5- helemaal mee eens) --> andere definities ook
- Welk begrip vind jij het lastigst om te beantwoorden? En waarom?
- Met wie bespreek jij dit als je het niet snapt? Coach?

Stap 2: 5 min
Bespreken van schaal mental readiness (1/2/3/4 prioriteit bij tijd tekort)
Acties
- Waarom denk je dat de coach zou willen weten hoe je mental readiness is?
- 1. Welke stappen verwacht je als je een hoge waarden invult bij mental readiness dat het team van experts zal gaan doen bij het bekijken van je data?
- Zou je deze acties graag vooraf willen weten & bespreken met je coach?
- 2. Welke stappen verwacht je als je een lage waarden invult bij mental readiness dat het team van experts zal gaan doen bij het bekijken van je data?
- Zou je deze acties graag vooraf willen weten?
- 3. Welke acties zou je zelf ondernemen als je merkt dat er een verschil is met vorige week in je waardes (hoog en laag) over mental readiness?
- Is het verschil bespreekbaar met je coach?
- Zou je het verschil merken? Zelf willen weten?

Afsluiting
- 4. Hoe betrokken voel je je bij het monitoren van je eigen ontwikkeling als atleet? Waarom wel of waarom niet?
- Wat zou voor jou helpen om terug te kijken/te reflecteren hoe mental ready je bent?
- Met of zonder team van experts (coach)?

Appendix P - Results final evaluation Group 2

Resultaten final test - Groep 2
Most difficult term: Mental readiness (3), Emotional state (2)

"I understand what is expected of me when filling in the term (likert scale 1-5)"
- Mental readiness 4.25
- Emotional state 4.33 (3 athletes)
- Motivation 4
- Physical readiness & Muscle soreness 5

Athletes often use the same words for describing other terms & often doesn't correlate with correct definition in mental, emotional & motivation

Mental readiness & Emotional state are very similar and relate to each other, which makes it difficult to make a distinction and mostly based on gut feeling.

"Het is soms lastig om mental readiness in te vullen, omdat ik niet weet wat ze van me verwachten bij het invullen ervan."

4 out of 4 don't search for help when they don't understand the Questionnaire

Expectations of undertaken actions of coach:
- only valuable when scoring low values, 4 out of 4 mentioned that isn't needed when it goes well & barrier of limited time of coach.
- 1 athlete mentioned that it would be interesting to take actions when giving oneself a 10.

"Term" represent for me ...
Mental readiness 4.25:
- Literature definition: Geestelijk alertheid, geconcentreerd, oplettend, open staan voor
- Athletes definition: zin in training (3), motivatie (1), hoofd opgeladen (1), stress (1)

Emotional state 4.33 (3 athletes):
- Literature definition: pleased, stable, in a good mood, having everything under control
- Athletes definition: stress (van externe factoren) (2), sociale context thuis of op school en gevoel erbij (1), lastige vraag om te beantwoorden (1)

Motivation 4:
- Literature definition: unmotivated, sluggish, unenthusiastic, lacking energy
- Athletes definition: gemotiveerd (1), zin in training (2), overbodige vraag want is combinatie tussen mental & physical readiness (1)

Physical readiness 5:
- Literature definition: Strong, physically capable, energetic, full of power
- Athletes definition: Vermoeidheid (2) & hoe fit lichaam voelt (4)
- Muscle soreness 5:

Literature definition: muscle exhaustion, muscle fatigue, muscle soreness, muscle stiffness
- Athletes definition: Spierpijn (4)