

# Folio

Loren

You've performed at a consistently high standard throughout the research process. Well done!

A+

Planning	Development
<p><b>A</b></p> <p>P1 Thorough consideration and refinement of a research question.</p> <p>P2 Thorough planning of research processes that are highly appropriate to the research question. +</p>	<p>D1 Thorough and highly resourceful development of the research. +</p> <p>D2 In-depth analysis of information and exploration of ideas to develop the research. +</p> <p>D3 Highly effective development of knowledge and skills specific to the research question. +</p> <p>D4 Thorough and informed understanding and development of one or more capabilities. +</p>
<p><b>B</b></p> <p>P1 Consideration and some refinement of a research question.</p> <p>P2 Considered planning of research processes that are appropriate to the research question.</p>	<p>D1 Considered and mostly resourceful development of the research.</p> <p>D2 Some complexity in analysis of information and exploration of ideas to develop the research.</p> <p>D3 Effective development of knowledge and skills specific to the research question.</p> <p>D4 Informed understanding and development of one or more capabilities.</p>
<p><b>C</b></p> <p>P1 Some consideration of a research question, but little evidence of refinement.</p> <p>P2 Satisfactory planning of research processes that are appropriate to the research question.</p>	<p>D1 Satisfactory development of the research.</p> <p>D2 Satisfactory analysis of information and exploration of ideas to develop the research.</p> <p>D3 Satisfactory development of knowledge and skills specific to the research question.</p> <p>D4 Satisfactory understanding and development of one or more capabilities.</p>
<p><b>D</b></p> <p>P1 Basic consideration and identification of a broad research question.</p> <p>P2 Partial planning of research processes that may be appropriate to the research question.</p>	<p>D1 Development of some aspects of the research.</p> <p>D2 Collection rather than analysis of information, with some superficial description of an idea to develop the research.</p> <p>D3 Superficial development of some knowledge and skills specific to the research question.</p> <p>D4 Basic understanding and development of one or more capabilities.</p>
<p><b>E</b></p> <p>P1 Attempted consideration and identification of an area for research.</p> <p>P2 Attempted planning of an aspect of the research process.</p>	<p>D1 Attempted development of an aspect of the research.</p> <p>D2 Attempted collection of basic information, with some partial description of an idea.</p> <p>D3 Attempted development of one or more skills that may be related to the research question.</p> <p>D4 Attempted understanding and development of one or more capabilities.</p>

## Consideration and Refinement of Research Question

### PMI

**Pluses** – My topic affects every sprinter on the planet so it is highly relevant to a lot of people. My question also looks at how sprinters can use the information I collect to enhance their performance. This makes my findings more useful. I will also be able to take the knowledge and skills I develop throughout the project to help those at my local athletics club who struggle with sleep problems. ✓

Because I'm involved in athletics, it should be fairly easy to find interviewees and gain quality primary research. I might also be able to get an interview with a sleep specialist which will provide me with a large amount of reliable information. ✓

Another positive of my topic is that I should be able to conduct some case studies, allowing me to manipulate conditions to follow leads. There should also be a lot of sources on sleep as it is a topic which is quite mystified. ✓

**Minuses** – The effect of sleep on sprinting performance is quite a specific topic to look at. Sleep is one of the least understood topics so conclusive information may be harder to come by and there might be quite a bit of conflicting information. Qualitative data will be hard to come by so a lot of cross-referencing will be required which will take up a lot of time. ✓

**Interesting** – For me, this research could be very beneficial. Because I sprint, I can apply the things I learn to my own life. As I do my research I'm going to find out lots of new information about my body, and in particular my brain and how it works. ✓

### Question Refinement (Extracts):

**1. How does amount of sleep affect performance? (22/10/14)**

- My original idea was to do my research project on sleep because it was a topic that I didn't know too much about but that has a great effect on sporting performance, which I am very interested in. ✓

**2. How does the amount of sleep an athlete gets each night affect their mental and physical performance both positively and negatively? (29/10/14)**

**3. How does the amount of sleep an athlete gets each night affect their performance both positively and negatively? (29/10/14)**

**4. How does the amount of sleep an athlete gets each night affect their performance? (29/10/14)**

**5. How does the amount of sleep an athlete gets each night affect their mental and physical performance both**

**positively and negatively and how can this information be used to optimise performance? (07/11/14)**

- This question specifies that athletes are now being examined and what parts of performance are being analysed. ✓

- The end of this question also examines how the information I find can be used to benefit others. ✓

**6. How does an athlete optimising their sleeping habits help to enhance both mental and physical performance? (02/02/15)**

**7. How can an athlete optimise their sleeping habits to lead to an enhancement in both mental and physical performance? (11/02/15)**

**8. (FINAL QUESTION) How does the quality and quantity of sleep a sprinter obtains affect their mental and physical performance and how can this information be used to best enhance their performance? (15/02/15)**

- The question is now looking at two specific aspects of sleep: quantity and quality.

- 'Athlete' seemed too broad and so I chose to look into the sprinters specifically. I chose sprinting because I have contacts in athletics, which will be helpful for primary research; I am part of a club; and it is also a passion of mine.

- Mental performance will look at reflexes, concentration and attitude.

- 'Best' was added as it means that the outcome is looking to enhance performance as much as possible. ✓

### Preliminary Research

I considered three internet sources which gave me a brief overview of how easily I would come by information on sleep. These sources provided lots of useful information that was relevant to my question so I concluded that I had found a well-researched topic. *Good relevant*

### Planning of research processes appropriate to the research question

#### Ethical Considerations

There aren't many ethical considerations to take into account in my topic as I can do most of my research unobtrusively. Gaining parental consent when conducting case studies is the only ethical consideration I had.

#### Capabilities

I am planning on developing my critical and creative thinking capability throughout the research project as I feel these are two areas of life that I can make a large improvement in. I will do this by: learning how to apply new knowledge and skills, e.g. applying new findings to my overall research picture; explaining the reasons behind the choices I have made, e.g. question refinement; developing

a greater understanding of a range of research processes e.g. surveys, interviews and case studies; learning how to design a process so that I find the information I want e.g. case study; and learning how to find, organise, use and evaluate information e.g. arranging all my research, finding the relevant information and making it into an outcome. ✓✓

**Planning for Individual Processes (Example)**

**Systematic Review**

**Purpose** – To gather key findings from a number of reliable sources on a database. These key findings will then be tested in my case study. ✓

Good planning

Challenges	Opportunities
Finding a database that will provide me with enough sources on my topic.	Gather highly reliable information that is relevant to my topic.
Wording my searches correctly so that I am able to find sources relevant to my question.	Developing the critical and creative thinking capability of accessing, organising, using and evaluating information.

I have outlined the purpose of this specific research process in answering my question and a few challenges and opportunities. I did this for each research process.

**Consultation – Joel Fuller (Researcher in Exercise, Nutrition and Activity at the University of South Australia)**

**Purpose** – to work with someone who is an expert in the field of research at coming up with an effective case study for my topic.

Challenges	Opportunities
Getting in touch with Joel and finding a time where both he and myself were available to talk.	Develop a high quality case study that will provide me with a reliable source which I can cross-reference my other findings against.
Communicating with Joel clearly so that he is able to provide advice to me on how I should construct the case study.	Develop my critical and creative thinking capability and in particular developing knowledge and understanding of a new research process.

This is the same as the previous example in structure. However, this shows the effort I went to try and design a reliable and helpful case studies. I went and visited Joel at

the University of South Australia and he gave me some helpful information on how to structure my case studies.

**Permission Slips**

Great planning

**Athlete Slip**

As part of my Research Project on the effects of sleep on sprinting performance, I have chosen to conduct a case study.  
 For this case study to happen, I need sprinters. Before I am able to run the study however I need the permission of you (the child's parent or guardian) and the child to manipulate their sleep so that the effect of sleep can then be seen on their performance. The case study will involve three different parts: a good night's sleep, one bad night's sleep (1-2 hours off a normal night's sleep) and three bad night's sleep (once again 1-2 hours off a normal night's sleep). Each part will occur on a different week.  
 The effect of sleep deprivation on schooling and other activities obviously has to be taken into account. Please let me know below if there are any important events which I will need to schedule around for your child.  
 If you would allow your child to be a part of only one or two of the three criteria, please specify below as any information I am able to gather is highly beneficial!  
 Thank you for your time,  
 Luke Nicholls

These paragraphs outlined the specifics of the case study. In particular that the case study would involve their children being sleep deprived for a few nights.

I \_\_\_\_\_ give permission for the sleeping times of my child \_\_\_\_\_ to be manipulated as part of this research process and for my child to be a part of this case study.

Permission from the parent.

Signed \_\_\_\_\_

I will allow my child to be a part of all 3 sleep times: Yes No

If no, please circle the sleep times you will allow your child to be a part of:

- 1) Good Sleep
- 2) One Bad Sleep
- 3) 3 Bad Sleeps

I allowed for the fact that some parents may not want their children to be sleep deprived. This section allowed them to choose which amounts of sleep their child would be a part of. ✓

Special Events (just provide date):

I included a section where the parents could provide any special dates where the child shouldn't be sleep deprived.

**Coach Slip**

DI Astaded. ✓

I \_\_\_\_\_ give permission for the sleep of my athletes to be manipulated for the purposes of Luke Nicholls case study as part of his Research Project.

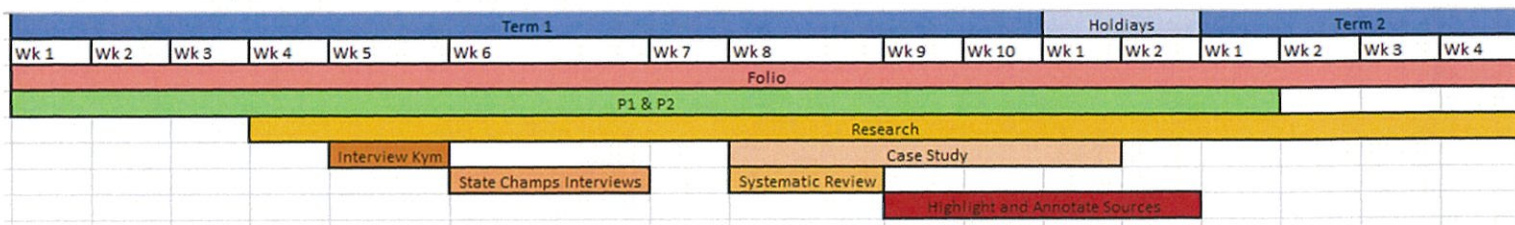
Signed \_\_\_\_\_

I had already talked to my coach about what the case study would involve so I only needed formal permission from him. ✓

**Systematic Review**

In preparation for my case study, I conducted a systematic review. Joel had recommended this to me as it provided me with lots of information from reliable sources which I could then use to construct my case study. It allowed me to more fully understand how other people had run similar research projects on sleep and provided me with useful insights into what did and didn't work in those projects. ✓✓

P2 A Astaded.



### Development and Analysis of Research

#### Systematic Review Examples

##### Source

Juliff, L. Halson, S Peiffer, J. 2014, 'Understanding sleep disturbance in athletes prior to important competitions', *Journal of Science and Medicine in Sport*, [http://www.jsams.org/article/S1440-2440\(14\)00035-8/abstract](http://www.jsams.org/article/S1440-2440(14)00035-8/abstract), accessed 27 March 2015.

#### Key Findings

Athletes often get worse sleep before a competition due to thoughts about the competition and nerves. This can affect their health, reaction time, concentration, attitude and mood. However, many athletes don't have any strategies to overcome these problems. To overcome these sleep problems, athletes need to: identify the problem; identify what is causing the problem; identify how the problem is affecting their performance; and identify how to overcome the problem. Problems are usually individual. Sleep is vital to good preparation and recovery which are the keys to success in sport.

D3

#### Usefulness/Limitations

The title (*Understanding Sleep Disturbance in Athletes Prior to Important Competitions*) indicated that I would be able to find out what prevents athletes getting a quality sleep and how they can improve their sleep and this was the case, as can be seen in the key findings. This relates mainly to the second part of my question, in using the information I find to best enhance performance.

#### Reliability

The three authors work in performance recovery, psychology and physiology at the Australian Institute of Sport and Murdoch University, this should mean that they are providing reliable information. Throughout the paper, their claims are backed up by reference to other reliable sources. The article was published in 2013, so the information should be up to date. It was published by the Journal of Science and Medicine in Sport, which is a reliable, internationally recognised database. They also state that there was no conflict of interest.

D3

##### Source

Mah, C. Mah, K. Kezirian, E. Dement, W. 2010, *The Effects of Sleep Extension on the Athletic Performance of Collegiate Basketball Players*, <http://www.journalsleep.org/ViewAbstract>

#### Capabilities, Skills and Knowledge Developed

Conducting this systematic review taught me a lot about how to find reliable sources. I learnt to think more critically, and in particular clearly define what information I wanted to find and then use key words to find this information. The systematic review also provided me with a large amount of new information. This included: specifics on how different quantities of sleep affect anaerobic performance, mood, attitude, reflexes and other aspects of mental performance; strategies and details into how athletes can overcome sleep problems, including the need for experimentation; the fact that athletes often don't get enough sleep before competitions; and that circadian rhythms affect performance.

D4

#### Key Findings

Increasing sleep to over 10 hours per night leads to faster sprint and reaction times, better mood, less fatigue, a healthier athlete and helps the athlete feel more positive about their performance. Naps have the same effect and can also improve sprint times after partial sleep loss. Athletes don't know how much sleep they actually need. This can cause them to build a sleep debt which affects performance more and more. Athletes should make sleep habitual. To find the right amount of sleep for them, they need to

#### Reliability

All the authors involved in this paper came from professional backgrounds involved with sleep, this should mean that the information provided is reliable. The paper was published in 2011, so is relatively up to date. Throughout the source, statements are backed up by reference to other sources. It is also stated that there were no conflicts of interest at the end of the article.

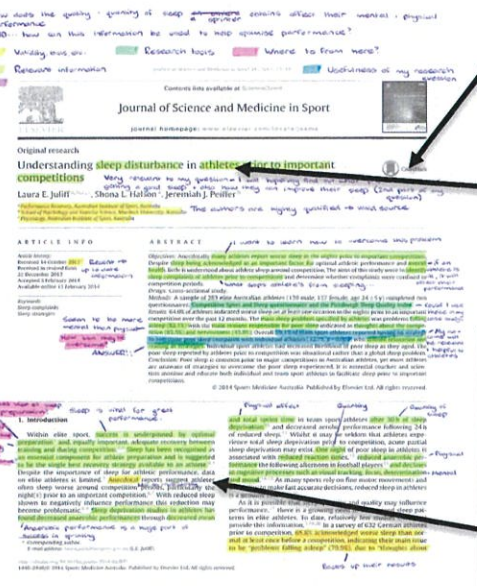
#### Usefulness/Limitations

The title of this source (*The Effects of Sleep Extension on Athletic Performance of Collegiate Basketball Players*) indicated that it would be helpful in developing my understanding of how the quantity of sleep obtained by a sprinter will affect their performance. Although the information was sourced from basketball players, a lot of it can be applied to sprinters as well.

D2

D2

D2



Source

Miller, K, 2015, Interviewed by Luke Nicholls, Adelaide, 5 March. Interview - Kym

How does the quality and amount of sleep a sprinter obtain affect their mental and physical performance... Have you seen anyone from the sprinters you have coached whose sleep has affected their performance?...

Key Findings
Sleep patterns, especially in young athletes, can be interrupted by a lack of discipline the night before a competition. Athletes usually sleep in group accommodation so the quantity of sleep is affected by the group mentality...

Usefulness/Limitations
The interview questions were structured to provide information relevant to my question. The information I gathered from Kym covered all aspects of my question...

Reliability
Kym has coached sprinters, and many other athletes, for over 20 years. He has coached national champions and many highly successful athletes. He is very motivated in helping his athletes to achieve at their very best...

Leads
As can be seen from the annotations in the margin, I had quite a few comments and questions. I followed my questions up with Kym. He provided me with lots of new information which help to redirect and further my research...

Capabilities and Skills Developed
This interview developed my ability to critically think about what areas I wanted to know more about and to come up with creative questions to obtain this information.

Interview Structure (cont.)
The first 3 questions were designed to gain information on how sleep affects both mental and physical performance. Questions 4-7 were aimed at gaining information about what sleep habits Kym recommends to his athletes...

Table with 2 columns: Challenges and Opportunities. Challenges include 'Getting the interview questions specific...' and 'Beginning the research process straight away...'. Opportunities include 'Get a lot of reliable information...' and 'Broadening the range of sources...'.

Interview Structure
The interview questions were:
1. Have you seen examples from the sprinters you have coached where sleep has affected their performance?
2. If so, how did it affect their performance both mentally and physically?
3. Did this affect their performance in your eyes?
4. Have you had sprinters that were unable to sleep well or had sleep problems?
5. Do you recommend certain sleep patterns to your athletes?
6. If so, how many hours do/would you recommend and when?
7. How much do you believe that optimising sleeping habits will enhance mental and physical performance?
8. Is there anyone you have met who you think would be able to provide me with more information relating to my topic?
9. Is there any other information that you think may be useful that you would like to add?

D2 A studied ✓

D3 A studied ✓

D4

D3 A studied ✓

Source

State Championships Athlete and Coach Surveys

Key Findings

Athletes Surveys

1. Has your sprinting performance been affected by the quantity or quality of sleep you have obtained in the lead up to a competition?

Most athletes answered yes, in particular getting less than 6 hours.

2. How did it affect your physical performance?

The lack of sleep caused the sprinters to be slow and sluggish, have a poor technique and experience fatigue.

3. How did it affect your concentration?

Athletes reported decreased focus, frustration and declines in confidence.

4. How did it affect your reflexes?

Athletes reported that they were slower than usual.

5. How did it affect your attitude?

Athletes said that they felt unmotivated, nervous, sorry for themselves and lacking in confidence.

6. What amount of sleep do you feel you need to lead to optimum sprinting performance?

Athletes and coaches recommended getting at least 8 hours of sleep a night.

7. Do you manage to get that many hours of sleep?

Generally, it was found that athletes would get this much sleep.

8. What stops you from getting that amount of sleep?

Respondents reported nervousness, homework, social commitments, electronics and a lack of discipline as reasons for failing to get the correct quantity of sleep.

9. How have you tried to overcome any sleep problems you have experienced?

Recommendations included: relaxing e.g. reading, listening to music or stretching, making a habit, avoiding alcohol and not eating too close to bed

10. Are your sleep patterns regular or do they increase around competition time?

Most athletes reported regular sleep patterns, especially as sleep is important to training performance and recovery as well as competition performance.

11. Is there any other information you would like to add about sleep and its effect on performance?

On coach said you have to set goals and stick to them. Another recommended seeking professional help if the provided solution didn't work.

D3 Astaded ✓

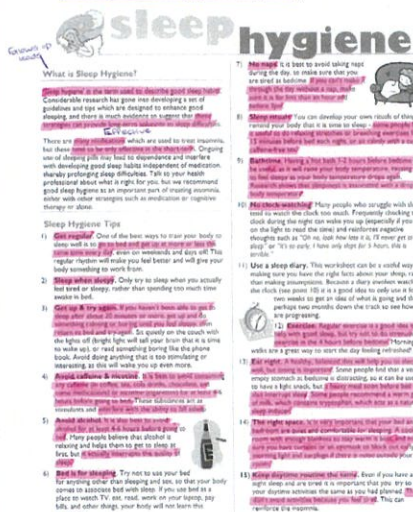
Usefulness/Limitations and Reliability

The survey questions were constructed to find information on how quantity and quality of sleep affect performance and also how to overcome any sleep problems. The information gained from the surveys was relevant to these areas and can be used in my outcome. The surveys also provided another primary source. However, the sample size was not large enough to provide a true representation of the sprinting community.

D3 Astaded ✓

Source

Centre for Clinical Interventions, N.D., *Sleep Hygiene*, <http://www.cci.health.wa.gov.au/docs/Info-sleep%20hygiene.pdf>, accessed 5 May 2015.



Usefulness/Limitations

This source provided some very useful information in answering a question I had about what sleep hygiene specifically was. This also can be used in my outcome to provide tips to sprinters on how to get more sleep and ensure that they get a good quality sleep.

Key Findings

Sleep Strategies can provide long-term solutions to sleep problems.

Sleep Hygiene Tips:

- Go to bed and get up at a similar time each day.
- Only try to sleep when you feel sleepy.
- Avoid caffeine and nicotine for 4-6 hours before bed as it interferes with your ability to sleep.
- Avoid alcohol for 4-6 hours before bed as it affects the quality of your sleep.
- Make your bed specifically for sleeping in.
- If you have a nap, make it less than an hour and before 3pm.
- Having activities you do each night before bed can help. These include: stretching, breathing exercises and sitting with a hot drink.
- Have a hot bath 1-2 hours before bed as the decreasing body temperature after makes the body feel sleepy.
- Don't watch the clock.
- Exercise is good but try to avoid strenuous exercise for the 4 hours before bedtime.
- Have a healthy and balanced diet but don't eat large meals too close to bed. Some people have a warm cup of milk, which contains a natural sleep inducer.
- Your bedroom should be quiet, cool and comfortable to sleep in.
- Don't avoid doing activities just because you feel tired.

D2 A Astaded

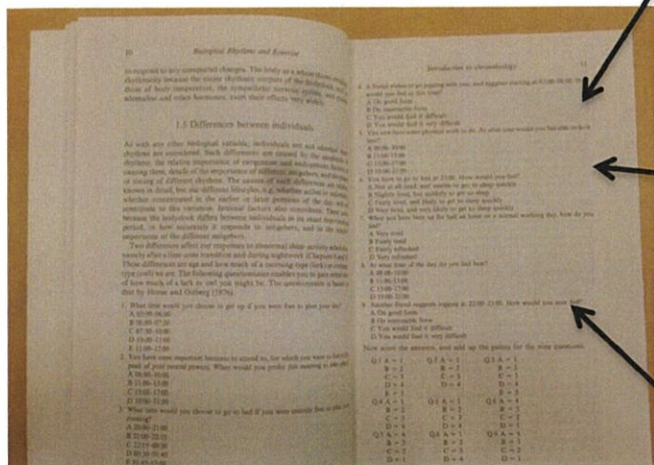
Reliability

This source did not have a date, which causes doubts about reliability. However, when cross-referenced with other sources that talked about sleep hygiene, it contained similar information. These cross-referenced sources were published recently. The URL of the source had .gov in it, which would indicate that it should have trustworthy information although it may be a little biased depending on the views of the particular government. The source was put together by the Centre for Clinical Intervention who specialise in psychotherapy, which involves treating of mental disorders, such as trouble sleeping. This indicates that the source should be a source of reliable information.

✓

Source

Reilly, T Atkinson, G & Waterhouse, J, 1997, *Biological Rhythms and Exercise*, Oxford University Press Inc., New York.



Key Findings

- Different people require different quantities of sleep and experience better quality sleep at different times.
- Circadian rhythms majorly affect performance.
- The time of day an event takes places affects both physical and mental performance.

Validity Usefulness/Limitations

This source was very long, and a lot of it was not related to my question. However, the information I obtained was very useful in allowing me to inform athletes how to get a better sleep. In particular, the information about circadian rhythms helped me to follow up a lead about whether or not circadian rhythms affect performance.

Reliability

This source was published almost 20 years ago, so the information contained in the book may be outdated. D3 ✓

Source

Potter, G. 2013, *Sleep Strategies for Strength, Speed and Size*, <http://www.elitefts.com/education/training/sleep-strategies-for-strength-speed-and-size/>, accessed 5 May 2015.

3/26/2015 Sleep Strategies for Strength, Speed, and Size / Elite FTS



TRAINING Sleep Strategies for Strength, Speed, and Size

TAGS: sleep videos, sleep for recovery, sleep deprivation, physical performance, Greg Potter



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elitefts™ Sunday Edition

In 1964, 17-year-old Randy Gardner set the sleep deprivation world record, clocking 264 hours under the beady eye of Stanford sleep researcher Dr. Dement. His parents must have been so proud. Gardner experienced impaired short-term memory and aggression, hallucinations, paranoia, and delusional behavior. After a couple days of catch-up sleep, Gardner appeared to undergo no further negative consequences of his experiment, as corroborated during multiple sleep analyses.

In this model of acute sleep deprivation, an otherwise healthy, young adult suffered no durable, negative consequences. But is this applicable to the rest of us?

Thirty to 45 percent of the U.S. population exhibits sleep and wakefulness problems (Hossain & Shapiro 2002). In light of this, what are the effects of sleep deprivation, and are there negative effects of insufficient sleep on health and physical performance outcomes? If sleep quality and duration prove to be important, what strategies can we use to optimize sleep?

Why we sleep

Numerous theories exist as to why we sleep, but the exact functions of sleep remain contentious. While most hypotheses hold that sleep serves the same role across mammalian species, few animals have been studied (Siegel 2005).

As sleep is divided into stages, the roles of sleep likely depend upon the stage in question. Non-rapid eye movement (NREM) sleep appears to play a role in the restoration of the nervous system and energy conservation. Rapid eye movement (REM) sleep seems to be important in local brain regeneration and modulating emotions. REM sleep appears to prepare animals for waking behavior; animals awakened from NREM sleep demonstrate impaired sensorimotor function in comparison to those awakened from REM sleep (Horner et al. 1997).

The fact that sleep debt accumulates suggests an essential role of sleep. During sleep deprivation, humans can't perform at high levels for prolonged periods (Blinks et al. 1999), and sleep deprivation in flies can cause death more quickly than food.

Key Findings

NREM sleep restores the nervous system and conserves energy while REM sleep is important in brain regeneration and modulating emotions. Sleep debt accumulates. Poor sleep impairs immunity, reduces optimism, motivation and sociability and causes increases in pain and discomfort. It also slows sprint times and has negative effects on strength and power. Sleep deprivation causes the body to lose lean body mass instead of fat. Acute sleep deprivation lowers testosterone and aggression levels which reduces motivation and the making muscle protein. Exercise programs that are designed incorrectly and overtraining can cause sleep problems. Extending sleep to over 10 hours per night leads to faster reaction times, improved mood and less daytime sleepiness. Napping improves sprint and reaction times for those who are sleep deprived. 10-19 year olds should get 8 and a half to 9 and a half hours of sleep each night while adults should get 7-9 hours of sleep each night.

Usefulness/Limitations

This source was extremely useful in answering a lot of my questions. These included: what the purpose of NREM and REM sleep is; how caffeine and alcohol affect sleep; and what kind of meals should be eaten before bed. The source delved into all aspects of my research question and was written in relatively easy to read language. I found this source towards the end of my research and it helped to tie together a lot of loose ends. It also provided me with a lot of new and relevant information. The source was also broken up into sections, each with a heading. This made it a lot easier to find information relevant to my question. D2 As stated ✓

Reliability

The source was written fairly recently, so all the great information I found should be reliable. EliteFTS is a company which was formed back in 1998. The aim of the company was to provide quality training advice to those who needed it. This should mean that this source provides pretty reliable information.

Skills and Capabilities Developed

Internet research taught me to think critically about the reliability and relevance of sources. A lot of my research came from the internet through journals of webpages. I learnt how to more effectively and efficiently take the information I had gathered, critically analyse it and then apply it in answering my question. The survey research process taught me to develop generic questions which will provide a relevant answer to my topic. D3

Case Studies

*D1*

3 Bad Sleeps

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Amount of sleep last night (to closest 30 mins): \_\_\_\_\_

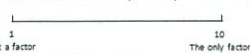
Sprints:

Distance	Time

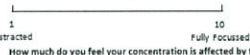
Attitude (towards training):



How much of a factor is sleep towards your attitude today:



Concentration (during sprints):



How much do you feel your concentration is affected by the sleep you had last night:



Reflexes (starts):



Overall Performance:



*✓✓*

**Results Sheet Structure**

This case study was designed to find out more about how the quantity of sleep affects different facets of performance. These were: attitude, concentration, reflexes and overall performance. There is a table at the top of the page which allowed for recording of times over certain distances at each training session.

*D3 ✓*

**Ethical considerations**

This was the only research process where I had considerable ethical considerations to take into account. During the case studies, the subjects quantity of sleep had to be changed up to find out how different amounts of sleep affected performance. For this to happen I had to get parental consent, as it is not particularly desirable to have a sleep deprived child, especially when they may have important assignments or tests due at school or significant competitions for athletics occurring during the testing period. I made up permission slips to solve this ethical issue.

*✓✓*

Challenges	Opportunities
Designing the case study correctly so I find the information that I want.	Gather information for cross-referencing and use another different type of source.
Getting people to be part of the case study.	Show that I am putting a lot of effort into this Research Project by put together my own case study.

*✓*

**Key Findings**

The findings from this source were highly unreliable so I have chosen to discount them from my outcome. They didn't follow much of a pattern and it was too hard to determine whether the changes in performance were due to performance or other factors.

*Good Analysis of the validity of the results*

**Usefulness/Limitations**

This source was designed to test previous findings and try and follow up leads. This meant that the findings from the case studies were highly relevant to how the quantity and quality of sleep affected mental and physical performance.

*✓*

**Reliability**

Before I began the case studies, I knew that the information I found would be fairly unreliable. This was due to the many variables involved in the case study which could affect performance aside from sleep. These variables included: the weather, health, wind, temperature, general life circumstances and also how seriously the sprinter takes training. The results came from the opinion of the athlete, which means they were subject to bias. This led to more unreliability.

Making the case studies more reliable would have cost a lot of money and facilities would have been hard to come by.

*✓*

**Capabilities, Skills and Knowledge Developed**

Conducting this research process taught me a lot about putting together a case study and will be useful if I have to do similar research in the future. During my systematic review, I observed the ways in which professional researchers had structured their case studies. I highlighted this in my research and tried to then apply it to my case study. This helped me to develop my ability to creatively use the information I had gathered in putting together a more effective case study. This process also taught me about designing features which are fit for a function. Specifically, I taught me to think ahead for challenges that may occur and to try and come up with creative solutions about how to overcome these problems. This included: the possibility of me not being able to get into contact with the subjects for a period of time, this meant that I had to try and give them all the information and materials that they needed to have before the case study began; doing trial runs with some of the athletes to try and understand how clear the instructions I laid out would be; and designing the results sheets so that they would be easy to fill in whether or not I was around. The most fundamental lesson that I learnt from this research process is that for the research process to be successful it is very important to have a clear purpose in mind before beginning the process.

This process also taught me to think critically about the variables involved in a process of this form. In my case study, there were a lot of variables aside from sleep which could have an effect on performance such as: weather, temperature, diet, health and life circumstances. This is an important skill to have as it allows for better planning before the study begins so that the results obtained are more reliable and the process runs as smoothly as possible. I was unable to entirely get rid of all variables in my study as it would have required a special indoor track, this meant that I had to think creatively to find a solution. To resolve the weather and temperature issue, I asked my coach to make short recordings of the weather on every training day so that I could take this into account. I also asked the athletes to keep their diets as consistent as possible before training days to reduce the diet variable. To resolve the health variable, I asked athletes to not record results when they were not feeling healthy. Life circumstances was a variable that didn't have a solution so I just had to leave it and factor it into the final results.

*Great critical thinking De Astudud.*



### Cross Referencing and Organising Key Findings

Laura E. Jullif, Shana L. Halson, Jeremiah J. Puffer, 2013, *Understanding sleep disturbance in athletes prior to important competitions*, <http://www.jams.org/article/51449-1490315-Abstract>, accessed 27 March 2015.

- Key Findings:**
- Athletes often get worse sleep before a competition than normal. (pg. 1)
  - Poor sleep will negatively affect an athlete's overall health. (pg. 1)
  - The main reasons for poor sleep are athletes thinking about the competition the next day and the athlete being nervous. (pg. 1)
  - Many athletes don't have strategies or methods to overcome sleep problems. (pg. 1)
  - Relaxing and reading are two strategies athletes use to overcome problems going to sleep. (pg. 1)
  - The keys to success in sport is to get the best preparation possible and to recover well. Sleep plays a key role in both of these. (pg. 1)
  - Attention of sleep preparation decreases sports time. (pg. 1)
  - One night of sleep deprivation reduces reaction time, **increases anxiety** and **reduces mood**. (pg. 1)
  - You have to be able to differentiate between chronic sleep problems and poor pre-competition sleep to be able to optimise performance. (pg. 2)
  - There are four key steps to overcoming poor pre-competition sleep problems. (pg. 2)
    - Identify what problem the athlete is experiencing.
    - Identify what is causing this problem.
    - Identify how this problem affects the athlete's performance.
    - Identify how the problem can be overcome.
  - Athletes are being offered strategies which can affect a person's ability to get a good sleep. **How to sleep problems are not individual.** (pg. 2)
  - A majority of athletes report external factors as the reason for their poor sleep. (pg. 3)
  - Professional athletes, such as sprinters, will probably feel more anxiety and nervousness than amateur athletes because they are solely responsible for their performance and success. (pg. 3)
  - Athletes may just need more education on good sleep hygiene so that use sleep to optimise performance. (pg. 5)
  - Athletes need to be individually monitored for their sleep habits to be able to identify and solve their sleep problems. It isn't a generic thing. (pg. 5)
  - Sleep strategies need to be specific to the sleep problem that the athlete is facing. (pg. 5)
- Where to from here:**
- How does lack of sleep affect preparation, recovery and future performance? (pg. 1)
  - Why do athletes believe that sleep has "no influence" on their performance? (pg. 3)
  - How would "daytime sleepiness" affect performance? (pg. 5)

Rolfe, T. Waterhouse, J. 2009, *Sports performance: is there evidence that the body clock plays a role*, <http://www.esports.org/abstract/M011941063>, accessed 28 March 2015.

- Key Findings:**
- Athletic performance is affected by the time of day? (pg. 1)
- Where to from here:**
- How do sleep patterns and habits affect the body clock? (pg. 1)
- Mah, C. Mah, K. Kazian, E. Demerit, W. 2010 *The Effects of Sleep Extension on the Athletic Performance of Collegiate Baseball Players*, <http://www.journals.lww.com/ajsm/abstract.asp?doi=10.1177/0898010110382824>, accessed 28 March 2015.
- Key Findings:**
- Increasing daily quantity of sleep to at least 10 hours each night significantly decreases fatigue. (pg. 1, 4)
  - Increasing daily quantity of sleep leads to faster reaction time, a faster blood and a decrease in fatigue. (pg. 1, 4)
  - Sleep extension also makes athletes feel healthier. (pg. 1)
  - Sleep debt build and affects performance more and more. (pg. 3)
  - Napping during the day is less beneficial to reaction time, **heart rate** and **concentration**. (pg. 1)
  - Some studies don't support these findings. They found that two nights of extended sleep increased reaction time and four nights of extended sleep had no effect on sprinting time. (pg. 1)
  - Athletic sleep patterns is important to athletes. (pg. 2)
  - Circadian rhythms affect performance. (pg. 4)
  - Athletes may not perceive their performance to be better when their sleep is extended. (pg. 6)
  - Extending sleep also benefits an athlete's health. (pg. 6)
  - Athletes don't actually know how much sleep they need. (pg. 6)
  - Extending the amount of sleep doesn't affect performance goals. (pg. 7)
  - Athletes have to be encouraged to find their optimum quantity of sleep as it differs from one athlete to another. (pg. 7)
- Where to from here:**
- Can an athlete sleep too much? (pg. 1)
  - What is the optimal sleep quantity of a sprinter? (pg. 1)

Sargent, C. Halson, S. Roach, G. 2013, *Sleep or swim? Early-morning training severely restricts the amount of sleep obtained by elite swimmers*, [http://www.tandfonline.com/doi/full/10.1080/13613191.2012.696711#\\_ftn\\_4](http://www.tandfonline.com/doi/full/10.1080/13613191.2012.696711#_ftn_4), accessed 28 March 2015.

- Key Findings:**
- Early morning training severely restricts the amount of sleep an athlete is able to obtain. (pg. 2, 6)
  - Less than 6 hours of sleep limits the effectiveness of training sessions. (pg. 2)
  - Sleep deprivation affects cognitive capacity, glucose metabolism and immune function. (pg. 2)
  - Athletes don't get to bed early enough and then take a long time to go to sleep. (pg. 5)
  - Athletes who don't get enough sleep have a poorer mood and higher perceived levels of exertion. These effects can then affect motivation. (pg. 5)
  - A sleep deprived athlete has an increased likelihood of developing upper respiratory tract infections and other health problems. (pg. 5)
  - Athletes take longer to get to sleep because of increased levels of anxiety, hydration programmes, muscle soreness and also having caffeine or alcohol close to bedtime. (pg. 5)
  - An athlete can't significantly advance their bedtime for two reasons: hard to fit in with social commitments, your circadian rhythms won't allow you to sleep in the early evening. (pg. 6)
- Where to from here:**
- What quantity of sleep should elite athletes generally aim for? (pg. 2)
  - How does sleep deprivation limit the effectiveness of training sessions? (pg. 2)
  - Should athletes try to sleep more after training sessions to get full benefit from the training sessions? (pg. 4)
  - What should athletes be doing on rest days to optimise performance? (pg. 4)

Samuels, C. 2008, *Sleep, Recovery, and Performance: The New Frontier in High-Performance Athletics*, <http://www.pgsed.ufpr.br/Referencias08/Samuels2008%20FL.pdf>, accessed 25 March 2015.

- Sleep deprivation affects cognitive function. (pg. 170)
- Sleep deprivation also affects learning and neural plasticity. (pg. 170)
- Individuals respond differently to the same amount of sleep deprivation. (pg. 170)
- Sleep deprivation affects neuroendocrine and immune function. (pg. 171)
- Some people may get enough sleep each night but the quality of their sleep is not good enough. (pg. 171)
- Circadian rhythms affect quantity and quality of sleep. When the circadian preference and the sleep schedule don't match, sleep quantity and quality are affected. (pg. 171)
- Each individual has their own unique circadian rhythms. (pg. 171)
- Circadian rhythms can be changed by use of a seasonal affective disorder light. This can help "night owls" to adjust their sleeping rhythms so that they are able to train earlier in the day without the many negative effects that can occur. These changes will lead to weight gain, improved strength and better performance. (pg. 173)
- For individuals to get the best sleep possible, they need to delve into the cause of any sleep problems and find how to solve these problems. (pg. 173)
- An adequate sleep for an adult is 7 hours. (pg. 174)
- Adolescents need 8-10 hours of sleep. (pg. 175)
- During adolescence, the sleep phase will usually occur later during a 24 hour cycle. (pg. 176)

Souissi, N. Sesboue, B. Gauthier, A. Larue, J. Davenne D. 2003, *Effects of one night's sleep deprivation on anaerobic performance the following day*, [http://www.researchgate.net/publication/10768705\\_effects\\_of\\_one\\_night's\\_sleep\\_deprivation\\_on\\_anaerobic\\_performance\\_the\\_following\\_day](http://www.researchgate.net/publication/10768705_effects_of_one_night's_sleep_deprivation_on_anaerobic_performance_the_following_day) accessed 10 March 2015.

- Key Findings:**
- 24 hours of sleep deprivation doesn't affect anaerobic performance. 36 hours will have an effect on anaerobic performance. (pg. 1)
- Where to from here:**
- How can an athlete overcome jetlag? (pg. 1)

Taheri, M. Arabameri, E. 2012, *The Effect of Sleep Deprivation on Choice Reaction Time and Anaerobic Power of College Student Athletes*, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3307962/>, accessed 30 March 2015.

- Key Findings:**
- One day of sleep deprivation has no significant effect on anaerobic performance. (pg. 1)
  - Reaction time is significantly affected by one day of sleep deprivation. (pg. 1)
  - Sleep plays an important role in keeping attentional mechanisms working well. (pg. 1)
  - Sleep deprivation causes cognitive slowing, memory impairment and decreases in vigilance and sustained attention. (pg. 1)
  - 36 hours of sleep deprivation affects anaerobic performance. (pg. 2)
  - Sleep quantity seems to affect mental performance more than physical performance. (pg. 5)
- Where to from here:**
- Will educating athletes about sleep cause them to experience more anxiety and nervousness? (pg. 2)
  - What parts of the brain are more responsive to sleep loss? What are the functions of these parts of the brain? (pg. 5)

### Cross-Referencing

Throughout the entire research process, I cross-referenced from sources to find similar thoughts and facts between my sources. Throughout the systematic review (the pictures are the key findings from the systematic review) I found a lot of information which was backed up by the other journals. Another positive from the systematic review was that it provided many reliable sources which I used to cross-reference other less reliable websites. Cross-referencing will lead to more reliable information, which will lead to my outcome being more reliable and therefore useful to athletes who are looking to enhance their performance. ✓ ✓ D3 Astaded

### Organisation of Key Findings

During the research processes, I gathered a lot of information. However, it was important that I was able to cull all this information down so that it can be used in my outcome. To do this, I chose some key topics from the information which were relevant to my question, and using highlighters, I was able to find all the information relating to this specific topic. I was then able to summarise all this information into a concise summary which I will be able to use in my outcome. Organising my key findings in this way also aided me in finding cross-references, as I didn't have to read through all the information but just look for the common colours of the topic I was interested in. ✓ ✓ D3

### Following Leads

This picture demonstrates how I identified answers to questions I had from previous sources. Asking these questions helped to further direct my research. This picture also helps to demonstrate the consistency between sources in the information they provided. ✓ Astaded

### Research

How does the quality and amount of sleep an athlete gets affect their mental and physical performance and how can this information be used to optimise performance?

Elliot, D. 2014, *The Doctor Who Coaches Athletes on Sleep*, <http://www.theatlantic.com/health/archives/2014/04/for-better-performance-athletes-need-sleep/361942/>, accessed 5 February 2015.

- Athletes become more emotional than strategic with a lack of sleep.
- "We now know that 24 hours without sleep, or a week of sleeping four or five hours a night induces an impairment equivalent to a blood alcohol level of .1 percent," he said. "We would never say, 'This person is a great worker! He's drunk all the time!' yet we continue to celebrate people who sacrifice sleep for work."
- If you don't sleep after training or a game, or any kind of learning, you won't actually learn.
- Benefits of sleep - clearer thinking, more consistent metabolism.
- Sleep deprivation drops testosterone levels significantly which affects strength, bone density and well being.

Where to from here?

- How much sleep does an athlete need to avoid these consequences? (New source pg 10)
- What would an optimal amount of sleep be? (New source pg 10)

Fatigue Science, 2013, *Sleep to be an all-star: Why athletes should make sleep a priority in their daily training (Infographic)*, <http://fatiguescience.com/2013/09/03/infographic-why-athletes-should-make-sleep-a-priority-in-their-daily-training/>, accessed 5 February 2015.

- By incorporating adequate sleep into their routine, tennis players get a 42% boost in hitting accuracy.
- Sleep improves split-second decision making ability by 4.3%.
- After 4 days of restricted sleep, an athlete's maximum bench press drops 9kg.
- Roger Federer gets 11 to 12 hours sleep per night.
- LeBron James gets 12 hours of sleep per night.
- Usain Bolt says that sleep is the most important component to his success.

Where to from here?

- Why do professional athletes sleep so much? (New source pg 7)
- How does it help to improve their performance in their respective sport? (New source pg 7)

Schultz, J. 2014, *These Famous Athletes Rely On Sleep For Peak Performance*, <http://www.buffpost.com/2014/08/13/these-famous-athletes-rely-on-sleep-n-5650345.html>, accessed 5 February 2015.

- Sleep is an important component to an athlete's routine.
- Get more before game day.
- Allows your body to recover and gives you a fresh mental and physical outlook when you wake up.

## Understanding and Development of one or more Capabilities – Critical and Creative Thinking

23 February

### **Reflecting on, adjusting and explaining their thinking and identifying the reasons for choices, strategies, and actions taken.**

Up until this point, I have mainly developed this particular skill through my question refinement. Initially my reasons for changing my question were quite shallow and brief. As I have discussed my question with further contacts and made it more specific, I have significantly improved at being able to critique the wording of my question, make adjustments and then give in depth reasoning for these adjustments. ✓

5 March

### **Learning and applying new knowledge and skills.**

After going to the state library, I have discovered that circadian rhythms could have a major effect on sleep quality and quantity and therefore how well an athlete performs. This means that when I design case studies and write up interviews, I will have to take into account how circadian rhythms may also affect the subject. ✓

19 March

### **Developing knowledge and understanding of a range of research processes**

As part of my preparation for my case study, I went into to Uni SA to talk to a researcher named Joel Fuller. I chatted to him about designing my case study and he really developed my knowledge and understanding of case studies and systematic reviews. Initially I had been thinking that I would just have everyone under the same conditions each week, Joel suggested that I mix it up however so that I have people under each of my three variables each week. He also introduced the research process of systematic review to me. He suggested that before I design my case study, I should find around 10 reliable sources relating to my topic on a database and summarise the information found in these sources, looking for similarities and differences. He then recommended that I design a case study which would be able to test the findings of this systematic review. ✓

4 April

### **Designing features that are fit for a function (e.g. physical, virtual, textual)**

Designing my case study has taught me a lot about designing features specifically so that they are fit for a function. First of all, to be able to design correctly, you must have a clear purpose as to what you want to achieve. I then went and did research to see how other people who had conducted similar studies had designed their features. ✓ As I went through these sources, I would highlight sections

that I thought I might be able to use in my own case studies. I then put together two sheets for gathering data and asked two of the subjects involved in the case studies to fill them out. I did this to test how effective the methods for gathering data would be in developing the outcome that I desired. I have learnt that to design features fit for a function: it is necessary to think very critically; to research; and to be very specific. ✓

29 April

### **Accessing, organising, using, and evaluating information**

Conducting a systematic review taught me a lot about accessing, organising, using and evaluating information. First off, I had to find around 10 reliable sources. Initially, this was quite difficult, but as I kept researching I realised that knowing exactly what I wanted was integral to finding quality sources on my topic. When I had summarised each source, I had a lot of great information but it was all over the place. I had to pick out some key topics which I used to break up the information from each source. Then I had to identify the key findings from all this information so that I could use it in my outcome. Throughout the whole process, you have to be evaluating the validity and usefulness of each source. ✓

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DI A studied.