

The Effect of Ranking on Final Performance of Collegiate American Swimmers in Relation to Preliminary Times

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Abstract

In the current swimming environment, swimmers are placed in lanes based on the timings they had swum in the preliminaries, with the fastest swimmer traditionally being in the middle lanes (lane 4). It is currently known that there is no physical disadvantage to being in the outside lanes, but the psychological effect is not known. This study will be determining if lane placement does play an effect on collegiate-level swimmers in the United States. This study aims to find deficiencies in the National Collegiate Athletic Association's (NCAA) running of the national swimming championships and remedy them to make swimming a more equitable sport where every athlete is given an equal chance of performing. It was found that no statistical results could be made with a p-value of 0.21, but other conclusions could impact the NCAA and the audience: maintaining audience expectations for a swimmer's performance and contributing to the scholarly conversation surrounding swimming and the factors that impact swimmers.

Keywords: Behavioral and Social Science; Swimming; Equity; Collegiate Athletics; Mental Toughness

1. Introduction

Elite-level swimmers have an extraordinary work ethic, talent, as well as mindset control to ensure that they are able to perform at peak levels when they are required to. These athletes are required to function with no room for excuses; discerning factors that may affect results would be beneficial in maintaining their performance and help swimming organizations remedy their competition structure. Mindset, particularly, is a major factor in sports for students and elite-level athletes alike, so much so that, if a person has more of a growth mindset than another athlete, that person is more likely to experience more performance success (Ferranti, 2012). Seeding in swim meets, where the fastest swimmer gets the middle lane, and so on, also affects the swimmer's mindset, since it casts relative aspersions on their ability relative to who is in their field. The main purpose of this project is to determine to what extent factors such as mindset and seeding in certain swim events can affect a swimmer's performance relative to the preliminary swim. In order to do this, data points regarding seeding (ranking) within each event from the NCAA Championships (annual championship for swimming) were taken from the prior ten years to determine if athletes had made an improvement and then grouped them with respect to their ranking. First, the initial area of research was to investigate to what extent factors such as playing environment, playing field/area, pollution, sleep, emotions, and pressure affect an athlete's performance (Dahl, 2013).

Realizing that this is a heavily researched area, the research area was specific to the specific sport of swimming so as to gain more meaningful results. By finding that swimmers are affected mainly by signs of overtraining or stress/mindset-related issues, the research was specialized further to focus on a specific factor of rank to determine what effect it would have on elite athletes.

2. Literature Review

Most of this research lies in ranking swimmers within a specific swimming event and determining whether that affects their performance (i.e., the difference between the preliminary swim and the time in that specific race).

One article investigated the number of swim races that a swimmer swims over the course of a year and how a specific amount may lead to overall development; the researchers concluded that a greater number of races correlate to a growth mindset as well as resiliency, which ultimately led to overall development in the swimmer's growth and performance (Born et al., 2020). This implies that mindset is a contributing factor for swimmers and how it leads to a healthier environment and better performance. Corroborating that resiliency and emotional toughness is a core tenet among elite-level athletes; another article reported that the mindset an athlete has when going into a specific race is also of importance, describing that "emotions should be an important area of mental preparation" (Samelko et al., 2020). This article, however, does not address how one specific factor, which is an attribute of mindset, relates to performance. These two pieces of literature emphasize that mindset is a vital part of swimming: one major factor in the mindset of a swimmer is that the outer lanes are at a disadvantage due to the inner lanes being higher ranking, as well as that the outer lanes are closer to the wall and are "supposedly" more vulnerable to the turbulence of the water (Hocking and Hutchinson, 2010). This article takes a more scientific approach to determining the "detriment" of out lanes, rather than considering the mindset perspective. Hocking and Hutchinson display that lane placement, relating to what the first two articles may attribute to their mindset condition. If lane placement does indeed influence an athlete's performance, it can be partially correlated and thereby contribute to the conversation of the effect of mindset on swimmers, since it has not been explored by previous research papers.

Because athletes are able to function with a high level of mental toughness, researchers learned that they are able to 'tune out' their surroundings to put more emphasis on the race. Mental Toughness (MT) is an attribute that is found among elite athletes and high achievers which allows them to operate with "greater levels of control and confidence under stressful situations" (Lin et al., 2017). Lin et al. indicate that the population of people in any type of capacity who are high achievers do tend to have MT, enabling them to ignore outside distractions to focus on the goal they wish to achieve; this perspective mainly argues that outside factors (such as lanes within a swimming event), should not play a big role in the performance of an elite level athlete. An article corroborating this perspective develops a viewpoint that can be transcribed to multiple ability levels of athletes. This article reports that the more ability that an athlete is able to manage reactions to stressors, the better they are equipped to perform (Bryan et al., 2017). This article shows that there is an array of abilities in this field, and it describes how mindset can be a factor depending on the circumstances. Ultimately, the result of which the swimmer swims is based on the performance shown; however, if all swimmers perform a certain way due to the established conditions, then the conditions need to be changed.

In order to run the experiment, it would have to assume that the rest of the conditions for the athlete leading up to the tournament are the same. This can be partially alleviated since the NCAA Championship is one of the most prestigious national-level swim meet that occurs annually. For a big swim meet, swimmers usually decrease their training cycle in order to perform at their best; this process is called taper (Mortenson, 2022). This helps ensure that at least a majority of those athletes would be entering the meet during a similar cycle of training, thereby eliminating one factor of deviance among the athletes. This project, although, is unable to account for several other factors such as health and any other extenuating circumstances that the athletes have gone through. For this experiment, it will assumed that the athletes will be going to the NCAA Championships during 2012-2022 under similar conditions as found above.

In all the research articles discussed previously, none of them mentioned the quality of the rank, and ultimately, the lane in which a swimmer was in, as a factor to affect any sort of metric concerning the swimmers' mindsets and their ability to perform. Hocking and Hutchinson had set the groundwork for why the outer lanes, it may affect their performance through the mental aspect, only the physical aspect (Hocking and Hutchinson, 2010). By using the factor created by Hocking and Hutchinson, new research will be created to determine if mindset measured by the rank/lane would be detrimental or would have no effect on a swimmer's performance and ultimately contribute to the conversation of factors relating to athlete performance. This is the gap in the current literature surrounding this topic as there is no research from the mental perspective regarding lane placement for swimmers and it is contributing to

how the rank may play an effect from a different perspective.

3. Methods:

The topic of inquiry is the effect of seeding in high-level national swim meets, and the effect on the swimmer's overall performance, in comparison to his/her preliminary in that specific event. This would identify how rank would affect the improvement of swimmers in a meet where they would all be in a similar phase of training and be prepared to perform.

A meta-analysis of the different high-level swim competitions, using the results of each predetermined event, will be used to gain an understanding of the effects of mindset (rank) on personal performance. The meta-analysis method emphasizes the verifiable nature of the experiment, as it involves taking various other experimental or analytical studies to determine if a conclusion can be met by combining the expertise between the multiple studies. By looking at national swim meets and seeing the lane placement of each swimmer in comparison to their improvement on their preliminary time, their rank placement effect will be revealed; the result of this lane placement may likely create a noticeable effect in the athlete's performance. From Leedy and Ormrod (2014), meta-analysis is when “[t]he researcher combines the results of many experimental and/or ex post facto studies to determine whether they lead to consistent conclusions”.

3.1 Data Collection

The chosen research method is to use meta-analysis in order to derive a correlation between the rank of a swimmer within a specific swimming race, and their ability to either improve or add time to their preliminary swim. “A meta-analysis is primarily a statistical technique...” (Leedy and Ormrod, 2014). This shows how meta-analysis is a valid research technique and obtaining data from various swimming competitions to gain a better understanding of past events and make implications about the future, justifies the use of a statistical and quantitative technique. First, a list of the NCAA Swimming Championships from 2010 to 2020 is compiled in order to present a range of effects that would be relevant to the modern era at a high-level annual national meet. Then the time that each specific athlete in the events of 100 Freestyle, 200 Freestyle, 100 Backstroke, 200 Freestyle, 100 Butterfly, 200 Individual Medley (IM), and 100 Butterfly is collected using the SwimSwam Website (a highly reputable swimming news reporting site that is curated by former Olympians and swimmers) timing repository (SwimSwam, 2023). Each event would be classified by gender, stroke, distance, and separate each time within the categories by the specific athlete. For each entry of athletes, the lane they had swum in for each race, their preliminary swim, retrieved from the NCAA website, and the time that they went in the finals for each specific swim would be noted.

All data would be categorized in an Excel spreadsheet by gender, competition, stroke discipline, and stroke distance; for each entry within each category, the preliminary time for the athlete in that event would be noted, as well as the timing that the athlete swam in that specific competition. This data collected will determine the difference between a swimmer's preliminary and final time, and the lane in which he/she swam. The organization of swimming implies that the lane in which a swimmer is seeded relates to their overall rank within that specific race (with 4 being the fastest, then 3, 5, 2, 6, 1, 8). Creating a data set that shows a swimmer's improvement in relation to the lane in which they are swimming would contribute to the overall research question by showing a correlation between the two variables. The improvement can be calculated by the difference between the previous preliminary swim and the time swum at that specific meet; the rank in that specific race can be calculated by the lane in which the specific swimmer was. In the sources described above, they used similar techniques by taking datasets from NCAA-approved swim competitions and doing their analysis regarding it; those studies include the ones by Fogaca and Stoa (Stoa et al., 2020). In this study, Fogaca and Stoa explore the effects of motivation on swimmers and their stress and fitness levels that were pulled from a database, which ultimately lead to their performance levels (Stoa et al., 2020). By using similar studies as established literature, the methods are justifiable and are available for use to come to a significant conclusion for the topic selected. Some limitations to these methods include the difference in the swimmer's conditions. There are different phases in a swimmer's training cycle, causing them to perform at a specific level. One way the variation in

results is mitigated over time is to choose a swimming competition where most swimmers would be at a similar phase in their training.

3.2 Analysis

The data generated by this method was analyzed using hypothesis testing for means. The hypothesis testing for means will take into account the mean difference (between final swim and preliminary swim) for both high- and low-ranking lanes, and determine if there is a statistical difference, or is that difference due to chance. First, the people in the high-ranking lanes, signified by ranks in the domain from [1,4] or lanes in the dataset {4,5,3,6}, and the athletes in the low-ranking lanes, signified by ranks in the domain from [5,8], or lanes in the data set {2,7,1,8} were grouped respectively. Then a randomly selected group of 30 athletes over the course of ten years in both of the categories described above is selected. Next, a 2-sample (for high- and low-ranking samples) T-Test (with an alpha of 0.05, selected due common-place conventions) for means is conducted in order to determine if the means of both samples are the same or statistically negligible. The 2-sample T-Test will produce a p-value, either higher or lower than the alpha value stated above; if the p-value is higher than the alpha-value, then it can be determined that any difference between the means can be accounted for by chance, however, if the p-value is lower than the alpha-value, then it can be determined that the difference between the means is significant and there is a statistical significance to the means.

4. Findings

Swimming requires copious amounts of skill, and collegiate swimmers who compete at the NCAA championships are those who have achieved great things in the sport; they can be considered elite-level athletes. This raises the question of how a swimmer's ranking in the NCAA championships relates to his/her preliminary swim.

To explore this question, data from past NCAA championships were analyzed. The performances of swimmers across the most versatile event were observed: the 200 IM. The 200 IM includes all four-stroke disciplines, and with the event being a 200, it incorporates some degree of endurance as well as sprints.

One example of the relationship between ranking and personal preliminary swim can be seen in the men's 200-yard IM event at the 2022 NCAA championships. The first-seeded individual had a time of 97.7 seconds, 1.13 seconds faster than his preliminary swim of 98.3 seconds, while the second-seeded swimmer swam a time of 98.21 seconds, 0.5 seconds faster than his previous swim of 98.21 seconds. While several other events had also shown similar trends, this was the event that had shown the most prominent results. Thus, it is inferred that top-ranked swimmers in this specific event are able to perform significantly better than comparatively lower-ranked swimmers between each swim.

Another event that showed such prominence of results was the men's 100-yard freestyle at the 2018 NCAA championships. The top-ranked swimmer finished with a time of 0.06 seconds slower than his preliminary time, but the second-ranked swimmer finished with a time of 0.08 seconds slower than his preliminary time (SwimSwam, 2023). While there is a difference of 0.02, with the smaller value being with the higher-ranking swimmer, using other events as a comparison can degrade down to a minimal difference. After analysis of the short duration of the race, it was determined that a difference of 0.1 seconds or lower can be considered negligible.

However, there are some circumstances where the relationship between ranking and the personal preliminary swim is less clear. For example, in the men's 200-yard freestyle at the 2017 NCAA championships, the top-ranked swimmer finished 0.46 seconds slower than his preliminary swim of 1:30.31. Meanwhile, the fourth-ranked swimmer finished with a time 0.22 seconds slower than his preliminary swim of 1:30.80. It is inferred that for other reasons outside of the scope of the research question, such as race strategy and mental preparation, may play a role in a swimmer's performance in this event; with swimming being a highly complex sport, it would be difficult to pinpoint which of those external factors would come into play. In this example, rank does not seem like it was a factor in the results of the race, because the lower-ranked swimmer had improved a value of 0.24 seconds greater than the top-ranked swimmer. While this may seem negligible, this experiment determines that values with a difference of over 0.1 seconds are considered to be of significance due to the close margins in swimming where 0.01 seconds can decide a result.

Additionally, it is important to note that the relationship between ranking and personal preliminary swim can vary depending on the event. For example, in the women's 100-yard freestyle event at the 2019 NCAA championships, the first-seeded swimmer swam a time of 46.03 seconds, 0.31 seconds slower than her preliminary swim of 46.57 seconds (SwimSwam, 2023). However, the second-ranked swimmer swam a time of 46.61 seconds, 0.05 seconds slower than her preliminary swim. In this case, it appears that the difference in performance between the top-ranked swimmer and the second-ranked swimmer was very small, suggesting that the margin of error for these elite athletes is incredibly narrow and can vary from event to event.

It is important to note that different swimming events across different genders may yield a unique relationship between ranking and the difference between the final swim and the preliminary swim. In the women's 100-yard freestyle at the 2019 NCAA championships, the first-ranked swimmer swam 0.31 slower than her personal best while the 4th ranked swimmer swam a time only 0.05 slower than her personal best. It shows that the margin, in this case, is considered to be moderately noticeable, but this margin is extremely small; therefore, it is hard to gain statistical analysis from the results.

This data visualization (Figure 1) was created using the 2022 Men's 200 IM reports. The orange line represents the overall percentage difference between the prelim and final time, indicating that a higher percentage would mean that the swimmer added time between those two swims. The two clusters indicate the different finals (A and B). As seen, as the rank decreases in each final, the percentage difference has an increasing trend. This indicates that as the rank decreases, the swimmer has a higher likelihood of adding to their preliminary time. Rank can be a factor in a final performance, specifically in the 200 IM.

Hypothesis testing regarding the difference in means between the preliminary swim and final swim by using 30 random samples over the years specified previously was performed. A p-value = 0.21 was produced, which is greater than the alpha value of $\alpha=0.05$. Overall, the data from past NCAA championships suggests that ranking in high-level collegiate swim competitions has no significant effect on a swimmer's performance in relation to their preliminary swim. In many cases, top-ranked swimmers and bottom-ranked swimmers were both able to perform close to their full potential in high-pressure competitive situations with only very small differences between their performance in the championship and their preliminary swim, as seen in figure 1, there is a negligible difference rank 12 (which would be rank 4 in that heat) and rank 13 and 14, in terms of differences between preliminary and final swims. There are also a large number of cases where other external factors may impact a swimmer's performance. Note that this analysis is based on historical data and does not necessarily apply to all swimmers or all NCAA championships. The results help contribute to the overall scholarly conversation of what affects a swimmer during competition and what does not, helping the swimming world change in a way that would be beneficial to the swimmers.

In conclusion, while the relationship between ranking and personal preliminary swim can vary depending on a range of factors, the data from past NCAA championships suggests that there is generally no correlation between these ranks and the finals times of swimmer performance. While no implications can be made, some conclusions could be made; by eliminating a factor of effect in the swimming community, stronger implications can be made for future research due to the lesser number of confounding variables.

5. Discussion

The findings of this study highlight the importance of ranking in high-level collegiate swimming competitions, such as the NCAA championships. The results demonstrate that in many cases, top-ranked swimmers are able to perform close to their full potential in high-pressure competitive situations, with only very small differences between

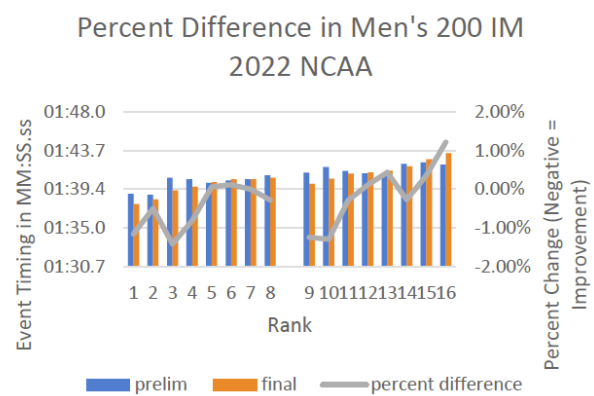


Figure 1: Chart of Results of 2022 Men's 200 Individual Medley

their performance in the championship and their preliminary swim. However, there are also cases where other external factors, such as race strategy and mental preparation, may impact a swimmer's performance. This can also be corroborated by other research papers where it was reported that such mindset changes can lead to changes in stroke operation, which ultimately changes the swimmer's speed (Liu et.al, 2021).

The results show that the lane is not related to the mindset of a swimmer, which was uncovered by an article that reported, “Corroborating that resiliency and emotional toughness is a core tenet among elite-level athletes” (Samelko et.al). Also finding that the mindset of an athlete going into a specific race is also of importance, reporting that “emotions should be an important area of mental preparation” (Samelko et.al). From the results, it can be seen that ranking does not affect a swimmer's performance.

One of the key implications of this study is that swimmers and coaches should not prioritize their ranking in high-level collegiate swim competitions. Since the results were different for each event, developing training programs and strategies that focus on improving performance in specific events and taking steps to optimize performance under pressure may be utilized in the future. For example, coaches may work with swimmers to develop effective race strategies for certain events that prioritize ranking in comparison to other events, such as the 200 IM.

It is also important to note that this study is based on historical data and may not necessarily apply to all swimmers or all NCAA championships. Changes to the NCAA's championship format, or other external factors, may impact the relationship between ranking and preliminary swim in the future. Therefore, future studies should continue to examine the relationship between ranking and performance in high-level collegiate swimming competitions and account for any changes or developments that may impact this relationship.

Overall, this study provides valuable insights into the importance of ranking in high-level collegiate swimming competitions. By highlighting the relationship between ranking and personal preliminary swim, this study offers important guidance for swimmers and coaches as they prepare for these events and strive to achieve their best possible performances. As such, the findings of this study may be of significant interest and relevance to a wide range of stakeholders in the swimming community.

6. Conclusion

The data summarizes the lack of effect of which ranking plays an important role in national-level collegiate swimming by exhibiting that the rank of the swimmer in a race does not play a role on their ability to ‘drop’ time between their preliminary swim and their final swim. The data obtained from the previous year NCAA's show clearly the effects of such ranking on such results. These conclusions can be made from the p-value of the tests ($p = 0.21$), where it was greater than the given alpha level of 0.05. The result of this study is only a part of a larger discussion in the world of athletics, where governing bodies aim to make competition between athletes as fair as possible. This study sheds light on the fact that ranking is a non-issue factor in athletic proceedings conclusively at a collegiate level. With the 2023 NCAA championships occurring this year, considering the multitude of different factors that may play a role in the athlete's performance is important.

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