NFL Ready

In college football, many players have the intentions of making it into the big leagues, the NFL. However not all college players are guaranteed entrance into the National Football League. It takes superior players that excel over others to make it to this elite group. Many college players seek to be selected in the NFL draft; an event where the NFL elects those college players who are eligible teams to be on their teams. But how do these players get selected? Most of these players are watched throughout their seasons and deemed star players, but usually their is no calculation on their performance besides their running speeds, their 40 yard dash time. Sometimes these calculations do not work for every position, especially quarterbacks. Quarterbacks can be elite by their passing and rushing yards, even their lack of interceptions. But what about their passing speed? When looking at a college players passing speed, it can be seen that the faster the throw by a quarterback the better they are. Looking at these college quarterbacks' passing velocity through physics, it can be seen if a college quarterback should play in the NFL. These statistics found through kinematics can be compared to NFL elite quarterbacks to see similarities and to compare their maximum throwing speeds. If a college quarterback's throwing velocity is closely related to that of an NFL quarterback, then they should be fit to play in the NFL.

In this experiment, the college quarterback of choice looked at is Marcus Mariota, to see if he fit in the NFL as a professional quarterback. It is important to compare him to a quarterback of high status in the NFL. This experiment will use Peyton Manning as a comparison because of his broken records, most touchdowns in the NFL and his MVP award. When starting to compare the two, both are analyzed for the same thing; their throwing speed to determine their max throwing velocity. This experiment runs into many limitations. Both specimens have thrown over hundreds of passes and not all passes will be analyzed, which is a limitation. The players also have games where they play in weather conditions that effect their throwing capabilities, such as wind or precipitation. Wind can highly affect a quarterbacks throwing velocity. However in this experiment these factors will not be put into consideration because there by a large sample of passes analyzed within numerous games with varying conditions.

When starting evaluation of these players, video footage had to be found of both. First Marcus Mariota was analyzed. Mariota, a current junior playing at Oregon has been in the news over the past couple of years for his great performance. In 2012, he competed 230 passes for 32 touchdowns and 2677 yards. He improved in 2013 with a

completion of 245 passes for 31 touchdowns and 3665 yards. SO far in 2014 he has completed 150 passes for 24 touchdowns and 2283 yards. It can be seen through these stats that Mariota is a great candidate for this experiment. He is a star player that is still excelling. This experiment will analyze a select few of these 625 passes that he has completed to determine his max throwing speed to see if he is capable of playing in the NFL (Football | NCAA | Player Stats).

When analyzing the footage of Marcus Mariota, nine different throws were analyzed. For each throw, the displacement of the ball was analyzed which was determined by the markers on the football field and then converted to meters since a football field is in yards. The time of the balls flight in the air was also recorded which was done by a stopwatch (Marcus Mariota Highlights).

The data for the 8 throws were:

1st Throw 9.144 meters in .96 seconds.
2nd Throw 17.37 meters in 1.06 seconds.
3rd Throw 47.55 meters in 2.13 seconds.
4th Throw 29.26 meters in 1.86 seconds.
5th Throw 23.77 meters in 1.13 seconds.
6th Throw 16.46 meters in 1.05 seconds.
7th Throw 10.06 meters in .91 seconds.
8th Throw 32.92 meters in 1.78 seconds.
9th Throw 29.26 meters in 1.48 seconds.

All of these throws came from different games that Mariota threw in. When calculating his maximum throwing speed, it was important to take calculations for numerous throws. To figure out the max throwing speed, 2-dimensional kinematics had to be used due to gravity. First the data had to be split into two components; its vertical speed and its horizontal speed. The horizontal speed was found by simply dividing the displacement by the time spent in the air. So for the first throw, to find $V_{x,}$ the displacement of 9.144 meters was divided by the time of .96 seconds, which would give the horizontal speed of 9.525 m/s^2 To figure out the vertical speed, gravity had to be taken into consideration. Important equations for 2-dimensional kinematics is $X_f=X_0+V_0t+1/2at^2$. When finding the vertical speed however we can simply multiply 1/2of the hang time by gravity, which is assumed to $9.8m/s^2$. So for the first throw the vertical speed would be 4.70 m/s. To find the total speed, both vertical and horizontal speeds are used. Both speeds are squared and then the square root is taken of the sum of the two. This was done for all of the nine throws recorded for Mariota. It was found through calculations that Mariota's maximum throwing speed from the data was 24.64m/s.

Peyton Manning, a number one draft pick in the 1998 NFL Draft, can be seen as a great NFL quarterback. He has

played for two teams since his draft, the Indianapolis Colts and the Denver Broncos. He has many awards and career highlights. He has won the Superbowl, been Superbowl mvp, 13 time probowl champ, 7 time 1st team all pro, 4 time NFL passing touchdown leader and many more. As of week 8, 2014 in the NFL season, Manning has completed 5,706 passes for 513 touchdowns and 67,098 yards (Peyton Manning). These statistics give credit to Peyton Manning for being one of the best NFL quarterbacks. If Marcus Mariota's max throwing speed compares closely to that of Peyton Manning, it can be concluded that he is suitable for the NFL.

Analyzing Peyton Manning's throwing speed used the same method as analyzing Mariota's. Video footage was analyzed for eight different throws. Each throw was recorded for its displacement and it's time in the air (Peyton Manning Highlights).

1st Throw 34.75 meters in 1.28 seconds.
2nd Throw 39.32 meters in 2.20 seconds.
3rd Throw 32.92 meters in 1.56 seconds.
4th Throw 14.63 meters in 1.06 seconds.
5th Throw 38.40 meters in 2.17 seconds.
6th Throw 11.89 meters in .97 seconds.
7th Throw 16.46 meters in 1.05 seconds.
8th Throw 35.66 meters in 1.36 seconds.
9th Throw 25.60 meters in 1.48 seconds.

All of these recorded data went through the same calculation as Mariota's data. Peyton Manning was recorded with a maximum speed of 27.87 m/s.

Looking at the data, a close correlation can be seen through Marcus Mariota's throwing speed and Peyton Manning's throwing speed. If a college quarterbacks max throwing speed is similar to that of a NFL quarterbacks throwing speed, then they are fit to play in the NFL. This is true for Marcus Mariota; he had a max throwing speed of 24.64 m/s, which was only a percent difference of 12% to Peyton Manning's max throwing speed of 27.87 m/s. This difference is not much for these 2 players when comparing an elite NFL quarterback to that of a college quarterback. The data of these two players and the comparisons of Mariota and Peyton's max throwing speed shows that Mariota has the ability to play in the NFL.

Work Cited

"Football | NCAA | Player Stats - Marcus Mariota - Oregon Ducks - Washingtonpost.com."

Football | NCAA | Player Stats - Marcus Mariota - Oregon Ducks - Washingtonpost.com. Web. 28 Oct. 2014. <http://stats.washingtonpost.com/cfb/players.asp?id=206121>.

"Marcus Mariota 2013 Highlights." *YouTube*. YouTube, 11 Jan. 2014. Web. 28 Oct. 2014. <http://www.youtube.com/watch?v=LxcKmymn35Y>.

"Peyton Manning." *Pro-Football-Reference*. Web. 28 Oct. 2014. <http://www.pro-football-reference.com/players/M/MannPe00.htm>.

"Peyton Manning Highlights." *YouTube*. YouTube, 17 July 2014. Web. 28 Oct. 2014. <http://www.youtube.com/watch?v=NfH002GS6Lw>.

Work Sample Evaluation

Subject Area: Physics
Task Title: NFL Ready
Student Work Sample Title: NFL Ready

The document was scored using the *CCR Task Bank Rubric*. The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Research and Investigation					**X**
Ideas and Content				**X**	
Reading and Analysis					**X**
Communication					**X**
Organization				**X**	
Accuracy				**X**	

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Research and Investigation: *Locating resources independently and/or identifying information within provided texts*	1	6	The work sample incorporates a large data set.
	1	24	The student used video footage of both players in order to compare and contrast their speed.
Ideas and Content: *Presenting a thesis and understanding concepts*	1	11	The thesis states that statistics found through kinematics can compare throwing velocities of different quarterbacks.
	2	22	The student understood that two- dimensional kinematics could be used to analyze the motion of the ball.
	2	26	Student failed to note that the vertical speed of the ball was dependent upon the speed the ball was thrown at, thus the sample draws an incorrect conclusion.
Reading and Analysis: *Evaluating sources and selecting evidence to support the central idea*	1	19	Limitations of the video analysis are noted which include 1) not all passes being analyzed and 2) adverse weather conditions.
	2	11	Data is clearly presented using tables.
Communication: *Using subject-appropriate language and considering audience*	1	20	Student describes how kinematics is applied to the problem at hand. Kinematics equations are written out and the method of determining time and distance are both explained.
Organization: *Structuring main ideas and supporting information*			The student's work is organized well and captures the reader's attention while supporting the central thesis.
	1	11	The work sample has a clear statement of the problem that the student intends to solve.
	3	21	The students draws a conclusion about the suitability of the college player to play in the NFL.
Accuracy: *Attending to detail, grammar, spelling, conventions, citations, and formatting*			The work sample was free of spelling errors. English conventions and attention to form could have been improved since the conventions used in the paper lead to a rather choppy read.