

Student 1: Low Excellence

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To ensure that the junior player improved, I needed to include a number of biophysical principles in my teaching of the physical skill of the volleyball serve. Some of the weaknesses the player had were, not extending his elbow when striking the ball and being upright and not using all the muscle groups to optimise force.

In my observation, I noticed that the player is not extending his elbow when contacting the ball this is having an effect on both the projectile motion of the serve and the amount of force exerted in the shot, this is related to the principle of force summation as well as the fact that $f=m \times a$. I therefore devised the balloon drill and then returned to the use of a ball. This drill would help to extend his right elbow using the triceps brachii (agonist) and biceps brachii (antagonist) muscles to strike the volleyball with an outstretched arm. Additional muscles (pectoralis major and deltoid) stabilise the shoulder to provide a stable platform for the extension of the arm. I noticed that here were deficiencies in his projectile motion. His height of release was a weakness that I identified due to the fact that he was not getting full extension with his striking arm. As the student is at the cognitive stage of learning for the overhand serve the height and angle of release is slightly different to a student at a higher stage of learning. This is due to the fact that the main outcome he is trying to achieve is to get the ball over the net and into the court, whereas someone at a higher stage of learning will be more concerned with placement away from players and as low as possible so the opposition cannot return the serve. Therefore, I worked on his angle of release being 45° and the height of release to involve a fully extended arm, instead of a flatter serve that others may wish to achieve. The drill I devised was the balloon drill. This drill would help to extend his striking arm to full extent. The angle of release is helped by the player hitting the ball/balloon from a higher point but aiming to achieve 45° . to ensure the volleyball can get over the net. The other aspect that the student needed to work on is applying sufficient force to get the ball over the net. There are a couple biomechanical principles I have had to apply involving anatomical principles as well that had to be considered.

1

Newton's Second Law tells us that when a resultant force acts on a body, it produces an acceleration which is proportional to the force, inversely proportional to the mass of the body, and in the same direction as the force this is the equation $f=m \times a$. The speed of the last part of the body at the moment of contact or release will determine the velocity attained by the projectile (ball) In other words, optimal performance requires the body movements to be performed in the correct sequence, with the correct timing. Many movements in sport are the result of the combination of a number of forces, which are performed in a sequence, this is the principle of force summation.

Force summation can also be applied by using muscles in order from the larger through to the smaller muscles in the movement of striking the ball. The muscles involved are the quadriceps and hamstring muscles, rectus abdominus, external obliques, latisimus dorsi, deltoids, triceps brachii and biceps brachii, wrist extensors and flexors. This means that the player will be able to generate more force and strike the ball with a lot more power because there are more muscles involved. So to get the greatest force being applied to the ball the mass of the muscles can be optimised through force summation and the acceleration can be optimised with timing of this.

He improved his force overtime with the drills and this was due to his timing and use of muscles improving, at the start he was standing quite front on and his legs were straight, he learnt to use his legs more and extend his knees better at the start of the movement (using the quadriceps-agonist and hamstrings-antagonist) by starting low (flexed at the knee) as well as using his trunk better (rectus abdominus, external obliques, latisimus dorsi, deltoids,) and in doing so rotating more. I knew his force was improving as he went from always being short of the net to being able to serve deeply into the opposition court. This showed me that he was learning to apply the force summation principle and therefore improving.

2

The biophysical principles involved in learning motor skills there were two major types of practice that I chose from 1. Massed practice: performing a skill over and over again without rest until it is achieved. The risks are: fatigue, poor technique, boredom, injury, frustration. Massed practice suits people that are highly motivated, low energy demand tasks and simple skills. 2. Distributed practice: performing the skill with rest sessions in between until the skill is learned. Distributed practice is often the preferred method when in the early stages of learning, energy demands are high, skill is complex, performer is not motivated, task is boring. As my student is in the cognitive stage and the skill is

complex I chose distributed practice. I believe that this type of practice did work as he did not get bored and didn't seem to tire, his technique improved and this was shown as after all the drills he could get 8/10 serves over and into the court where at the start he only got 1/10.

I also chose to use Whole– Part-Whole: this practice involves practicing the whole skill, then concentrating on the subroutines and then concluding with the whole skill again. I believe this worked to improve the students' skills as well as increasing motivation. I think the motivation increased as he saw when he first tried a lack of skill, when I broke it down into the subroutines he started to see how the serve actually worked and then when we came back to whole learning again he had really improved shown by the 8/10 at the end.

The drills I used were closed drills. This means there are no outside factors influenced the player and therefore keeping him focused. This is the most appropriate drill for a player in the cognitive phase of learning. An open skill would have too many other factors influencing him and he would lose concentration and not focus on the important parts of the skill. He can then progress to introducing these skills into a game situation and rather than have outside factors influencing the skill. This progression might include having the player serve to opposition or give the player a scenario (your team is winning 19-17) and the player has to close out the match by serving well. These game like situations would give the player challenges so that he could further improve his overhand serve. He could also then start to work on lowering the serve to an optimal trajectory.

The player is in the cognitive learning stage. This means he would need to have a lot of motivation and perseverance to complete the skills to a high standard. They also need a lot of feedback, this comes in many different forms and tells the learner how to improve their performance by comparing their current performance with the desired one. The main types of feedback he got were external, this came from me (I would give teaching points) I also tried to make my feedback positive eg "good work on extending that arm, just get the ball a bit higher" and knowledge of results (whether it went in or not), but some were internal where even if the ball had gone over sometimes he knew it did not feel right eg he said, "I think I did not follow through enough there". I also used visualization, which I helped by showing him the ideal technique, this allowed him to have seen the ideal so that he could visualise in his mind what it should look like. Visualisation involves using the mind to create images of how certain skills and situation will be performed. By putting images in his mind, the player could see how the drills are supposed to be performed and he could now have a better understanding of how to execute the skills. I actually do not think he used this that much, I think he relied more on immediate positive feedback from me or knowledge of results more. With this he would concentrate for longer and gain confidence in his own ability, which results in a higher chance of performing the skill correctly. The player's arousal level was kept at a high level because I would give him positive feedback. This would make the player feel good about himself after he receives positive feedback and therefore he would want to keep performing the skill. This comes from the inverted "U" hypothesis where I tried to ensure he was not over or under aroused.

Overall, I thought that the interrelationship between these bio-physical principles were very strong as the improvement in the force applied in his serve was due to force summation being optimised, this was through the use of the correct muscles in the right order with the correct timing. To do this the student needed to complete drills which I found were best as distributed and whole part whole learning and that this kept up the arousal level and motivation along with positive external feedback from me, leading to improved performance, not just in the final 8/10 for serving but also when he got back into the game situation.