

Enhancing PE Classes: Incorporating Velocity-Based Training for High School Students

Introduction

In recent years, there has been a shift in the focus of the physical education (PE) subject from the practical, to the theoretical. This 'academisation' (Brown & Penney, 2012; 2017) can be attributed to a desire for the subject to gain more legitimacy in its standing, both at the high school and tertiary level (Backman et al., 2019). To help facilitate this, many PE curriculums, at least in Australia, are either directly or indirectly underpinned by Arnold's (1979) 'in', 'through' and 'about' movement philosophy. Briefly, these three interconnected concepts can be described as follows. Education 'in' movement is concerned with "upholding the view that movement activities, especially when looked at from the 'inside' or participatory perspective of the moving agent, are in and of themselves worthwhile" (Arnold, 1979, p. 176). "Education 'about' movement examines the 'theoretical' body of knowledge related to movement. This form of enquiry encompasses content knowledge from diverse sub-disciplines as anatomy, exercise physiology, biomechanics, sociology and philosophy" (Brown, 2013, p. 6). Education 'through' movement is "...part of the educational process that aims to develop extrinsic learning objectives in the domains such as physical, emotional, intellectual, and social aspects of an individual through participation in selected and directed physical activities (Brown, 2013, p. 6). Brown and Penney (2017) noted that while the intention for an integrated approach to PE is admirable and warranted, their research indicated that it did not always translate to better results, with schools that focused more on the "about" movement element attaining better outcomes for students academically. However, I would suggest that when the right integration of "in" and "through" movement occurs, supported with appropriate technology, all aspects of learning are improved, which should hopefully result in greater levels of student achievement.

The role of technology

Coinciding with the increasing academic focus of PE has been the continuing development of sports technology. At present, many forms of technology—force plates, GPS, timing gates, heart rate monitors, video capture software and hardware and velocity-based devices—to name but a few, are all readily available and reasonably affordable for the high school PE or sports budget. All of these forms of technology can be used to enhance student

learning by allowing students to perform movement and gather data that can be used for analysis and evaluation of movement. The remainder of this article will look at how I have incorporated velocity-based training (VBT), specifically the GymAware RS device and the supporting cloud platform into the teaching of PE, with the ultimate aim of enhancing student learning and academic outcomes.

The role of VBT in PE – a worked example

Within PE in Australia, there is a significant focus on students analysing primary data to develop a strategy that can enhance their physical performance (QCAA, 2019). Furthermore, once students have implemented their devised training strategy, they need to perform an evaluation and justification of the strategy, using primary data they have gathered (QCAA, 2019). In this example, I am going to use long jump as the physical activity to show how VBT can be used to promote improved physical and academic outcomes. Long jump is a sport that requires participants to display high levels of speed, strength and power, as well as technical proficiency in the take-off, flight and landing phases (Linthorne, 2008). Therefore, students must create a strategy that will enhance these qualities.

Testing

To begin the process, having identified with students the necessary physical qualities for long jump, I conduct a series of fitness testing to establish baseline data. Due to time constraints, I limit this to an event test to establish how far they can jump before physical and technical training, a 1-repetition maximum (RM) back squat, a countermovement jump (CMJ) and a 40 m sprint. These four tests target the qualities described by Linthorne (2008), allowing the students to gather data for analysis to identify their current performance in speed, strength and power. It is here, when conducting the back squat and CMJ tests that I am first able to utilise the GymAware RS device. Students will work their way up to a 1-RM for a back squat, usually starting at around 50% of their estimated 1-RM and incrementally adding weight until such time that they successfully lift a load at approximately 0.30-0.35 m/s (mean velocity). Having used VBT with countless high school students, it is my experience that regardless of relative strength levels, this is the range in which their technical 1-RM occurs. Importantly, by using VBT we have established a load-velocity profile for each student, which can be used by them to improve the quality of their training and

aiding in their evaluation and justification. Other data that can be gathered here is the amount of force produced during the lift, which can also be used by the student as part of their assessment.

As noted, students will also perform a CMJ using the GymAware device. I prefer to use a 20 kg barbell held across the shoulders (like a back squat) but you could also use a wooden dowel or the belt, to which the tether can be attached. The data gathered here is multifaceted, with jump height, watts/kilogram and peak velocity being my preferred information. This data can be used by the student in the analysis of their performance, which they will then use to create their training strategy. For example, if a student performed well on the strength test, but their CMJ data was poor, as was their 40 m time and overall long jump distance, it is hoped that the student would infer that their training should look to maintain their strength levels, but increase their power and speed, as well as technical ability.

Analysis

As students begin their training interventions, they utilise the GymAware RS to monitor their performance. For example, using the load-velocity profile established during testing, a student may wish to focus on the development of muscular power and perform back squats for sets of 3 at 50-60% with less than 10% velocity loss across the set (Jukic et al., 2023). VBT allows for the student to accurately implement this training and based on the real-time feedback and make adjustments as needed. This data can also be used in their evaluation and justification of their training program to show that they either should maintain or modify their training based on the outcomes and what the data is showing.

The same student may also utilise loaded jump, which based on the work of Baker et al. (2001), I like to program using VBT with mean velocity speeds of between 1-1.2 m/s. VBT allows the student to quickly find this range and train in the most optimal zone for power development. Importantly, throughout the training intervention, utilising VBT and the GymAware RS device, students are constantly accessing objective feedback. For example, using the loaded jumps example, a student may be performing a loaded CMJ with approximately 50% bodyweight for a mean velocity of 1.05 m/s and 2800 watts of peak power output, with a relative power output of 40 watts/kg in their first week of training. Six

weeks into their training, the same student now moves that 50% of body weight load at 1.2 m/s mean velocity, producing 3400 watts peak power output and 48 watts/kg relative output. Having access to this data instantaneously, the students can also experiment with different loading parameters to determine where their peak power output is occurring, meaning each student is able to specifically target their optimal training stimulus to maximise performance outcomes and gather the most meaningful data.

Evaluation and Justification

As the training intervention comes to an end, students will re-test and use this data to evaluate and justify the quality of the training decisions they made. By using their pre and post-test data, students can gain meaningful insights into how their performance was influenced by the focus of their training. For example, if a student notes an improvement in their CMJ watts/kg metric, peak velocity, and their actual jump height, as well as an improvement in their long jump distance (but no other improvements in strength or speed), they would likely be able to infer that by improving that aspect of their performance, they were able to improve their long jump due to a relationship between power output and jumping distance (Linthorne, 2008).

Finally, students are required to justify whether they would maintain or modify aspects of their training intervention if they were to continue with the program. In the example above, the student would likely determine that the training that focused on power was successful and using the data that showed improvements they could justify the maintenance or continuation of that training. Conversely, if a student found that there were no or limited improvements, they could use data gathered from the GymAware RS to help determine why that was the case. In this instance, if power was not improved, it might be that the student was performing too many repetitions and power output was diminishing after the second or third repetition (Ratamess, 2021). This data could easily be attained via the GymAware system, allowing the student to note that in future instead of six repetitions, they would modify their power training to incorporate three repetitions per set.

Furthermore, given the student in this example did not improve strength or speed, they may wish to note that while their strength levels (force output – as measured by GymAware) did not improve, this could again be due to their training program not being optimal. The

data would likely show that their force output drops after their first five repetitions (McGuigan & Ratamess, 2009), any future training should focus on loads that allow for the highest level of force output, with minimal loss of force output across the set. Having established a load-velocity profile in testing, the students could be specific and note that strength is best improved using loads >85% (Peterson et al., 2004) which equates to initial repetition velocity of around 0.50 m/s in a back squat. When this is combined with the known importance of strength capabilities in long jump (Linthorne, 2008), the student can make a discerning justification of how they would modify and improve their training in the future.

Conclusion

In this article, I have discussed how the use of technology, specifically the GymAware RS device and VBT concepts can enhance a student's learning and contribute meaningful, objective data that can be used in assessment. It has also shown that by taking an integrated approach to the teaching and learning within PE, the 'in', 'through', and 'about' movement philosophy espoused by Arnold (1979) and embedded in many PE curriculum rationales can be brought to life with the help of technology.

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