The Developmental Pathways among Elite and Sub-Elite Collegiate Track & Field Athletes

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Abstract

The aim of this study was to examine the developmental pathway of elite and sub-elite Malaysian university track and field athletes. The study utilized a retrospective methodology using the Participation History Questionnaire on 54 collegiate track and field athletes. The elite group consisted of 15 males and 12 females chosen to represent Malaysia in the 2022 ASEAN University Games in Thailand. The sub-elite group included 14 males and 13 females who only represented their universities in similar sports. There was a significant age difference at the start of training, with sub-elites starting earlier than elite athletes. Similarly, sub-elites began representing their states at a younger age compared to elites. Furthermore, the sub-elite athletes started representing their universities earlier than the elite athletes. For the 20-28-year-old age range, the elite athletes had accumulated more hours in their structured activities than the sub-elites. However, as for the unstructured activities, there were no significant differences among the elite and sub-elite athletes. The findings showcased that during the sampling, the sub-elite athletes demonstrated a pronounced inclination toward early specialisation in their sport. Contrarily, the elite athletes engaged in the early diversification pathway and foundational skill acquisition over intensive training during their nascent years.

Keywords: Developmental Pathways, Early Specialization, Early Diversification, Deliberate Practice, Deliberate Play.

Introduction

The developmental pathway of an elite athlete involves a series of physical, psychological, and sociocultural factors that shape the individual's path to success in their chosen sport. The sooner an athlete began specializing, the sooner they would reach a high level of performance and those who began specializing later onwards would not be able to reach the same level of performance as their peers who began earlier (Ericsson, Krampe & Tesch-Römer, 1993). Thus, it can be said that the developmental pathway of an elite athlete is complex and multifaceted, mainly involving the volume and types of training carried out.

Thus, by understanding and addressing these factors, athletes and their coaches can help to optimize their development and increase the likelihood of success in their chosen sport.

Many different methodological techniques have been used to create models of athlete development, but few of these models have progressed beyond describing broad themes in this area (Côté & Vierimaa, 2014). The Developmental Model of Sport Participation (DMSP) is one model that has attempted to outline athletes' developmental pathways (Côté & Fraser-Thomas, 2007; Côté & Vierimaa, 2014). Based on the model, two pathways were distinguished from the beginning of sport participation to elite performance in sports by contrasting the type of activity based on either early or late specialization. The model was structured by deliberate practice or deliberate play theory.

According to the deliberate practice theory, an athlete's level of performance is a monotonic function of the amount of accumulated deliberate practice: a task-specific practice that is instructed and monitored by a coach and is undertaken to improve performance. It involves setting specific goals, carefully planning and executing practice activities, and continuously evaluating and adjusting one's performance in order to improve. One's performance entails frequent repetition of a task, is extremely laborious, and is not inherently enjoyable (Ericsson et al., 1993). Conversely, as for deliberate play, individuals engage in unstructured activities for enjoyment and gratification, with self-established game rules by them (Côté et al., 2007). Deliberate play refers to engaging in unstructured sports activities with peers (such as tags, backyard badminton and street football).

In order to understand how deliberate practice and deliberate play mould an athlete's development pathway, it is equally essential to understand early specialization and early diversification. These are the two main approaches to athlete development that have been the subject of much debate and research in the field of sports science. Early specialization refers to the practice of focusing on a single sport or specific skill at an early age, often to the exclusion of other activities (Güllich et al., 2021). In contrast, early diversification involves participating in a wide range of activities and sports during the early stages of development (Güllich et al.,2021). Rather than specializing in their main sport at a young age, athletes like Roger Federer, Michael Jordan, Wayne Gretzky, Michael Phelps, and Chris Hoy—athletes widely regarded as the best of all time in their sports—played a variety of sports throughout their childhood and adolescence (DeHority, 2020; Epstein, 2019; Hawkins, 2014; Landers, 2017; Mackay, 2017).

Numerous studies have been trying to identify the pathway taken by elite track and field athletes. A retrospective non-linear study (Barth & Güllich, 2021) investigated the associations of elite athletes' current and earlier participation patterns among 80 adult German track-and-field national squad athletes revealed that adult athletes who did not participate in coach-led practice in any sport until reaching the highest championship level and placing were at a greater risk of developing poor practice efficiency. Participating in around 1,250 hours of coach-led practice in various sports during childhood and adolescence was ideal for facilitating high-performance improvement in athletics during adulthood. Another similar study focused on the developmental pathway of the Portuguese expert track and field athletes (Coelho et al., 2021) revealed that the age at which one first participates in athletics, and the age at which one first begins to specialize were all similar in the expert and non-expert groups.

Furthermore, it was shown that track and field experts are typically distinguished from those who are not by the number of years they have spent engaged in unstructured activity. Subsequently, another retrospective study carried out by a team of academicians focused on the developmental pathway of Seventy-three Australian Olympic and World Championship Track and Field athletes (Huxley et al., 2017). The study showed that by the age of 17.7, the athletes began to focus solely on their primary event, with just a minority switching sports in their late teens. On average, Australian track and field competitors spent 10 years training before making their first senior national team, and over 12 years after they began to specialize in their main event before making their first Olympic team. This supports the ten-year rule for expert performance.

A similar qualitative study, a retrospective experiment on 16 world-class Caribbean track and field athletes with a mean age of 29 years old was carried out by a team of scientists (Thomas et al., 2019). According to the interview data, one possible factor in our participants' sustained interest in track and field is their recollection of having engaged in high amounts of unstructured play as children. Adding on the findings corroborate the developmental model of sport involvement, which calls for an increased focus on intentional play and multi-sport engagement in the ages 6–12 sample window. A closer-to-home study was carried out quantitatively by a group of academicians towards 117 athletes from two Malaysian national sports schools (Tan et.al, 2019). The findings of the study highlighted that individual sport athletes lagged behind team sport athletes by large margins in reaching virtually all sport-specific benchmarks. The individual sport athletes did not immediately begin competing in their primary sport. In contrast to their team sport counterparts, individual sport athletes have a longer history of national representation. When comparing the two groups, all the athletes spent more time on coach-led practice than on peer-led play.

All the aforementioned studies were conducted on athletes competing at the national and Olympic levels in their respective countries. (Barth & Güllich, 2021; Coelho et al., 2021, Huxley et al., 2017; Thomas et al., 2019; Tan et.al, 2019). However, in the context of elite and sub-elite collegiate athletes, there is still a lack of research to specifically identify the developmental pathway among track and field collegiate athletes in Malaysia. Previous studies have only researched the sport of badminton (Low et al., 2017), tennis (Leong et al., 2020) and national sports schools (Tan et al., 2019) but not specifically on track and field athletes. Thus, this research will underscore the need to understand the athletic backgrounds and training methodologies of Malaysian collegiate track and field athletes in order to gain a better and more comprehensive view of what has been contributing to their development. In that perspective, significant progress has occurred in the field through research using retrospective methodologies (Coelho et al., 2021).

Furthermore, this study will add on evidence to the existing body of knowledge through the findings by defining the developmental pathway activities of the elite and sub-elite collegiate track and field athletes. Moreover, there is theoretical evidence that elite track and field athletes are involved in greater levels of unstructured activities in their early ages and specialize at later stages compared to their less-skilled counterparts (Huxley et al., 2017; Thomas et al., 2019 Coelho et al., 2021). Therefore, this study sought to examine the developmental pathway of the elite and sub-elite Malaysian collegiate track & field athletes

by analyzing the structured and unstructured training they engaged in over the course of their athletic careers.

Methods

The 54 participants aged between 18-26 years recruited in this study were track and field collegiate athletes who were pursuing their studies in private and public higher institutions in Malaysia. The elite group of athletes consisted of males (n=15), and females (n=12) who were the athletes chosen to represent the Malaysian contingent in the 2022 Asean University Games (AUG) held at Ubon Ratchathani, Thailand. The mean age of the elite group of participants for males was (M= 22.8 years of age; SD= 1.9) and females (M= 23 years of age; SD=2.0). Meanwhile, the sub-elites consisted of males (n=14) and females (n=13), who were athletes who had not represented Malaysia in any competitions and had only represented in Sukan Institusi Pengajian Tinggi (SUKIPT) track and field competitions. The mean age of the sub-elite group of participants for females was (M=21.8 years of age; SD= 2.5) and for male (M= 21.0 years of age; SD= 1.8). All the participants were required to fill up the retrospective questionnaire The Participation History Questionnaire (PHQ; Ford et al., 2010) voluntarily.

Instrument

The Participation History Questionnaire (PHQ; Ford et al., 2010) was designed for various sports backgrounds. There were three components to this retrospective questionnaire: milestones in the main sport, activities relating to the main sport, and participation in other sports. The first segment gathered the ages at which the athletes began key phases of their primary sport, such as beginning to play, practice, or compete at a high level. The second portion of the report detailed the participants' time (in hours per week and months per year) in competition hours, coach-led practice, self-practice, and peer-led play devoted to the primary sport. Finally, the participants' involvement in other sports was required, including the ages at which they began and ended participating, the total amount of time devoted to each sport and the highest achievement in their particular sport.

The participants were briefed thoroughly by the lead researcher before answering the questions in the survey. The sub-elite groups were surveyed separately in another session, which was done during and after their daily routine training session held at their centralized training location. The participants were briefed with standardized instructions by the lead researcher regarding the research before being given the questionnaire. All the participants were informed to clarify if any doubts arose with the assistant volunteers regarding the survey. Adding on, the athletes received guidance and attention from the assistant research volunteers during the survey session to minimise errors. Once answered, the questionnaires were collected back from the athletes and labelled accordingly to be keyed in the Excel sheet to standardize the data and minimize errors during data analysis.

Data Analysis

The average age at each developmental milestone (the age at which an athlete first began playing, practising, or competing at each level) using independent sample t-tests. The weekly hours spent on sports were multiplied by the number of weeks in a year to get the total number of hours spent on sports in the main sport between the ages of 6 and 28. Separate 2 groups (Elites, Sub-Elites) x 2 types of activities (structured, unstructured) analysis of variance with repeated measures on the last factor were performed for 6-12, 13-15, 16-19,

and 20-28 years of age. The unstructured activity consisted of the hours participated by the athlete in playful activities for their main sport, while the structured activities consisted of the hours of competition, coach-led practice and self-practice for their main sport. The value of significance for all tests was set at p < 0.05. The data was analyzed using the Statistical Package for Social Sciences (SPSS) (Version 26).

Results

Age & Milestone

There was a significant age difference t (52) = 2.831, p= .007 in the analysis of the age that the AUG athletes started training (M= 14.1 years, SD= 2.8) at a later age compared to the SUKIPT athletes (M= 12.0, SD=2.7). Adding on, there is also a significant difference t (52) = 2.068, p= .044 in the analysis of the age that AUG athletes started representing their states (M= 13.2 years, SD= 1.9) later compared to the SUKIPT athletes (M= 11.4, SD= 4.2). The analysis revealed a significant difference in the ages at which AUG and SUKIPT athletes began representing their states. AUG athletes started representing their states later than their SUKIPT counterparts, with a significant t-value of t(52) = 2.141 and a p-value of .037. Specifically, AUG athletes began representing Malaysia at an average age of 14.7 years (SD = 3.6). The SUKIPT athletes started representing the country in their main sport at an earlier age compared to the AUG athletes. Moreover, a significant age disparity appeared t (52) = 2.128, p= .038 when examining the commencement of university representation among the athletes. On average, AUG athletes M= 21.0 years, SD= 1.8), started representing their university later compared to the SUKIPT athletes (M= 18.6, SD=5.7). This indicates that AUG athletes commenced their university representation relatively later compared to their SUKIPT athletes. However, there was no significant age difference in the analysis of the age that the AUG athletes started participating in their main sport, competition, and their supplementary training. Adding on, as for representing their school and districts in the main sport, both groups of athletes showed there was no significant age difference.

Structured & Unstructured Activities

The ANOVA with repeated measures analysis between 2 groups of athletes AUG and SUKIPT based on their structured and unstructured activities revealed that there was no significant interaction between the group of athletes and type of activities for the age range of 6-12, 13-15, & 16-19 years old. However, for the 20-28 years age range, the AUG and SUKIPT athletes based on their structured and unstructured activities revealed that there was a significant interaction between the group of athletes and type of activities where F (1,52) = 10.717, P= .002 for the age. The AUG athletics athletes accumulated significantly more hours in structured activities (M= 1910.84 hours, SD=1543.76 hours) than the SUKIPT athletes (M=621.81 hours, SD=1270.78 hours). However, as for the unstructured activities, there was no significant difference between the AUG athletes (M=77.14 hours, SD=214.62 hours) and the SUKIPT athletes (M=32.56 hours, SD=95.48 hours). There was a main effect for group, F (1,52) = 11.421, P=.001. The AUG athletes (M=1987.94 hours, SD=1758.38 hours) accumulated significantly more hours combined in both structured and unstructured activities than the SUKIPT athletes (M= 654.37 hours, SD=1366.26 hours).
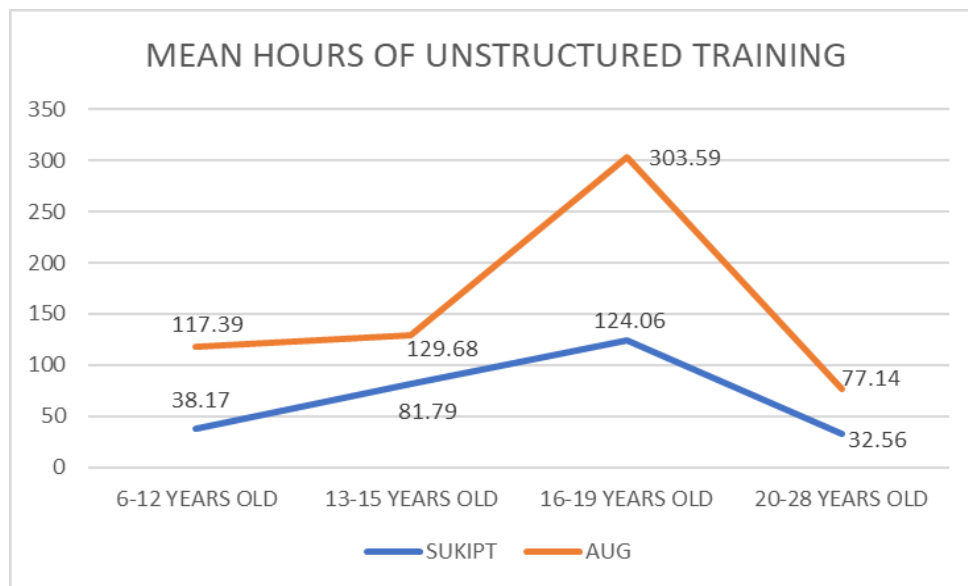
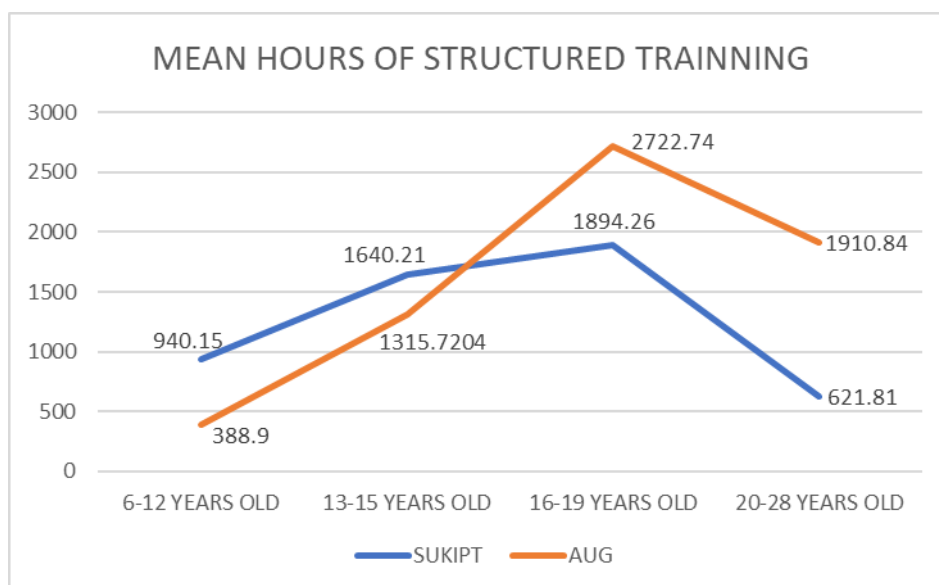Figure 1.1: The mean hours of unstructured training between SUKIPT and AUG athletes

Figure 1.2: The mean hours of structured training between SUKIPT and AUG athletes.

Discussion

Age & Milestones in Sport

The findings suggest that elite athletes started their formal practice in their main event somewhat later compared to sub-elite athletes. This is in line with the work of Güllich et al (2021), which found that, overall, senior world-class athletes started their main sport later and accumulated less specialized practice over their early years. This supports the idea that delayed specialization might offer a more sustainable and effective pathway to elite status, perhaps by reducing the risk of burnout and overuse injuries, and allowing an athlete to develop a broader range of skills through other sports participation. Similarly, the elite athletes in our study began representing their state, national, and university teams at a later age compared to sub-elite athletes. This delayed progression through competitive milestones

is consistent with Güllich et al (2021), findings that senior world-class athletes initially progressed more slowly than national-class athletes. The later representation at higher competitive levels would indicate such a process to be more gradual and encompassing, allowing for peak elite performance to be reached later in life but then maintained over a longer period. This suggests, therefore, that elite athletes may fare better following a more deliberate, stepwise specialization. This is also in line with the findings from the previously discussed study on Portuguese and Australian track and field athletes, which found the general recommendation of a diversified pathway during early years that involves structured and unstructured activities (Coelho et al., 2021; Huxley et.al, 2017). Moreover, in a study on Malaysian sports school athletes, Tan et al. 2019 found that individual sports athletes, who usually start their main sport late and engage more in diversified sports, attain higher performance levels than team sport athletes. This substantiates our findings that elite athletes, although they might practice several other sports or activities during the early years, eventually get specialized and reach higher performance levels in their main sport.

Structured & Unstructured Activities

The interaction between the type of activities and the athletes' level was also not significant in the 6–12, 13–15, and 16–19 years age groups. However, in the 20–28-year-old age range, elite athletes accumulated significantly more hours in both structured and unstructured activities than sub-elite athletes. This supports the argument that the best athletes are likely to engage in both deliberate practice and diverse, play-like activities even in adulthood, as proposed by (Güllich et al., 2021). Accumulating more hours through several different types of activities will help explain their better skill development while staying at high levels of performance. This is also in line with the study by Tan et al. in 2019 among Malaysian national sports school athletes, who found that athletes who were more diversified across a broad range of sports attained a higher level of performance. Furthermore, this finding is in line with the premise on which the term "sampling years," coined by Côté et al. in 2007, was based—that early diversification through participation in a variety of sports and unstructured play may have a positive association with better long-term athletic outcomes. This supports the view that both sorts of activities are paramount in developing elite athletes and is consistent with the findings of Huxley et al (2017), who emphasized diverse sporting experience and robust training regimens as being necessary for elite performance. The accumulation of additional hours of training by the elites within their twenties reflects the intensive and deliberate practice so important to achieve and maintain elite status. This period of intensified training is critical to peak performance, especially in late specialization sports such as track and field, where physiological and technical development are still attained up to the early twenties (Ericsson, Krampe, & Tesch-Römer, 1993).

Social and Environmental Factors

Moreover, the sociocultural context and environmental factors play a huge role in the development of athletes. The study from the Caribbean indicated that the critical influence on the development of world-class athletes included a conducive sporting environment, functional social support networks, and key organizational input (Thomas et al., 2019). Equally, much emphasis was put by the Portuguese study on balanced structured and unstructured activities meant to foster creativity, adaptability, and long-term engagement in sports (Coelho et al., 2021). Adding on, the intense training demands and single-sport focus can lead to burnout and dropout among young athletes, as noted by Thomas et al. (2019). The

study carried out by Huxley et al (2017), laid emphasis on strong social support systems, including the likes of family-based emotional and financial support, quality coaching, and good facilities. Although the current study did not explicitly measure these factors, it can be safely inferred that analogous influences would hold for Malaysian athletes as well. In a Malaysian context, delayed specialization in elite athletes could reflect this similar socio-cultural influence where a supportive environment allows for engagement in a variety of activities before focusing on a particular sport. This way, more skill acquisition and greater resilience might work in favour of Malaysian athletes who find success at the higher levels of competition.

The cornerstone of the study rested on the hypothesis that there was an absence of a difference in structured and unstructured activities engaged in by both elite and sub-elite athletes. However, findings unravelled the complexities that have shaped the developmental phases of these athletes from sampling to the elite performance years. One of the most revealing facets of this study was early specialization being a confluence and divergence among elite and sub-elite athletes. Not only that, sub-elite athletes competing in the SUKIPT category, for example, showed a high tendency toward early specialization, driven by the belief that technical ability should be harnessed at an early age. This trend accords with the study of Coelho et al (2021), who hinted that early specialization, under a well-structured intense training regime, might give athletes the upper hand in expertise attainment in the early years. In contrast, elite athletes went more holistic in suggesting that a focus on talent selection and early diversification has to be started from the earlier years. Moreover, this could be due to the fact that the geography of an area where an athlete is born and raised does appear to have some impact on national sporting success, however, there are too many micro and macro variables outside of geography with influence (Vialli & Marcotti, 2007; Walls, 2021).

The early specialization showcased by sub-elites could be also because urbanization has led to a decrease in public playing spaces, increased safety concerns, and the establishment of sport-specific developmental hubs in schools and community centres. As a result, children are more likely to participate in organized activities as per the guidance of their parents. This may account for the substantial number of practice hours during the sampling phase (Tan et.al, 2019). Likewise, with public playing spaces, children are more inclined to engage in unstructured sports activities, which encompass informal youth-led pursuits including street games (e.g., football and basketball), backyard activities, and school playground play (Coutinho et al., 2016). These activities offer children the chance to socialize and enjoy themselves through participation in games that are typically improvised and adjusted to various settings. Furthermore, engaging in these activities individually allows children to generate, modify, and discuss rules, so fostering the cultivation of crucial traits such as innovation, creativity, flexibility and versatility which is characterized by early diversification (Santos, et.al, 2017).

Conclusion
The main aim of the study was to investigate the developmental pathway of elite and sub-elite Malaysian university track and field athletes. The study found that the sub-elites are more inclined towards early specialization and the elites who excelled in sporting performance specialized in the later stages. Thus, it can be deduced that those who excel in

their main sport follow an early diversification pathway. The limitations in this study, are that the use of a questionnaire means that it is subject to retrospective bias. Memories will fade, and perceptions may change over time, and this eventually makes it hard to remember specific hours of training and the type of training. Interviews by parents and coaches of athletes have to be done to increase the validity and reliability of the data collected from the athletes. Furthermore, comparisons should also be made between athletes at national levels and those who have already represented the Olympics. It might shed some light on the benefits of specialization or diversification early, which might allow future athletes and coaches to choose the correct development pathway.

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