SCOTTISH FA

CLUB ACADEMY SCOTLAND

A CLUBS GUIDE TO BIO-BANDING

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FOREWORD
SCOTT MCTOMINAY

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Ballon d'or nominee Scott McTominay has been capped over 60 times for Scotland, made 255 appearances for Manchester United and was a Seria A Champion for Napoli in season 24-25. McTominay's journey exemplifies how late physical development can turn into long-term advantage— if supported by a developmentally informed player support system, resiliency, and careful consideration of the challenges and risks that accompany the pubertal growth spurt. Scott is also a standout example of why it is important to recognise and accommodate for individual differences in growth and maturation and how footballing excellence can be born from early adversity.

"When I was growing up I was an extremely late developer into my late teens, Man Utd were so good with nurturing me and giving me time to get my body in good shape to compete with fully grown men when that time came, but during my years of 15/16/17/18 I developed skills technically to use my body, to think quickly, to move the ball fast as I was physically not quick enough or strong enough so it helped me massively. I am obsessed with improving so I found myself doing a lot of gym work, pitch work to get to the level or a proper footballer and have maintained the same discipline to this day. It's good to see the Scottish FA are creating a system that helps players in a similar situation as me and allows them time to develop their potential."
Scott McTominay describes his journey

INJURY STRUGGLES & RESILIENT RECOVERY

- Growth-related injuries are common in young players: During his teenage years, McTominay gained between 9 to 10 inches (around 25 cm) in less than two years—from about 5'7" to 6'4". His rapid growth spurt led to coordination challenges and pain from growth related conditions such as Osgood-Schlatter disease, significantly limiting his playing time and confidence in those formative years.

- The importance of patience and support: Manchester United's academy staff, including figures like Brian McClair, Paul McGuinness, and Warren Joyce, recognised these challenges and risks and and nurtured Scott through a tailored training programme and reduced match load. Their patience and belief was pivotal to Scott's development.

- Mental battles and growth mindset: McTominay has spoken candidly about the mental toll of growing pains—recalling tough moments when he questioned if he'd "make it." His father's constant reassurance ("Be patient… you're going to grow…") was vital, and McTominay now views his late physical maturation as contributing towards his development as a player and as extending his potential peak years into his mid-to-late 30s.

- Physical setbacks in his senior career: In December 2019, McTominay suffered a knee ligament injury that sidelined him for roughly 10 weeks. He credited his swift return to the steadfast support from club physios, his family, and a rehab regime tailored to push him fully back—but carefully.

SIR ALEX FERGUSON

Manchester United and Scotland legend Sir Alex Ferguson was an key innovator in the measurement and management of growth and maturation in academy and talks about the importance of maturation, patience, and injury prevention when developing young players in his book, 'LEADING'. One of the themes he stresses is that players mature at very different rates — physically, mentally, and emotionally. He warns against writing a player off too early just because they haven't hit their physical stride yet. That's why, during his time at Manchester United, Ferguson often kept an eye on "late bloomers" and made sure the academy didn't discard them too soon.

> ***"The biggest risk was that we erred on our assessment of a particular boy and could have used his slot to work with a more talented boy youngster. We had to wait a little longer to see the real potential in some boys, because not everyone's physique develops at the same rate"***
> Sir Alex Ferguson (2015)

INTRODUCTION
GROWTH & MATURATION AND BIO-BANDING

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BIO-BANDING IN FOOTBALL

Bio-banding in football refers to periodically grouping young players based on their biological maturity (such as growth and physical development) instead of their chronological age (their actual age in years). Bio-banding is not a replacement for age group competition. Rather it is an additional format that can be used to challenge and evaluate players in a different learning context. This approach is used because young athletes of the same age can differ by as much as five to six years in their growth and physical maturity, especially during adolescence. For example, a 14-year-old boy who is an early maturer may be the size of a typical 16-year-old, while another 14-year-old who is a late maturer may resemble a 12-yearold in physical build. Differences in the timing of maturation are a result of genetic and environmental factors and children have no control over whether the mature early, on-time or late. Bio banding aims to reduce the physical disparities that result from differences in the timing of puberty by providing fairer, more inclusive and more diverse and optimally challenging environments for early, on-time, and late developers. .

GROWTH & MATURATION SCREENING

The Scottish FA have introduced Growth and Maturation Screening Protocols within the Club Academy Scotland system allowing eligible to play down a biological age group if their maturation age has been determined and approved by the Scottish Football Association (SFA) Clubs will be required to submit maturation screening data to the Scottish Football Association to approve. This approval is granted for a period of three months, with the four quarterly windows starting in January, April, July, and October. If approval has not been granted, players will be unable to play down an age group. This will be implemented across all age levels of the CAS programme.

GROWTH & MATURATION STUDY

Scottish FA have commissioned the biggest growth and maturation study in academy football in bid to aid early and late developers. .

- The study, conducted by the University of Bath in collaboration with Edinburgh University analysed the impact of relative age and biological maturation on player selection in the Club Academy Scotland (CAS) system.
- It highlighted that Scottish academies were losing potential talent due to a bias towards early maturing players.
- In conjunction with this study, a new pilot rule has been introduced which allows clubs within CAS to group an increased number of players by biological maturity, giving late-developing players more time to flourish.
- As part of the next stage of the study, selected Scottish academies will investigate the growth-related injury incidence in CAS and its impact on players playing time .
- Lack of knowledge in the measurement and management of the growth spurt was outlined as a key issue in youth development in the Scottish FA’s Transition Report, which was published last year

SUMMARY

In summary, bio-banding allows for development and evaluation in maturity-matched environments, aiming to support holistic player growth and reduce biases associated with physical differences in adolescent footballers [Sean Cumming on bio-banding - FIFA Training Centre]

WHY
WHY IS BIO-BANDING IMPORTANT?

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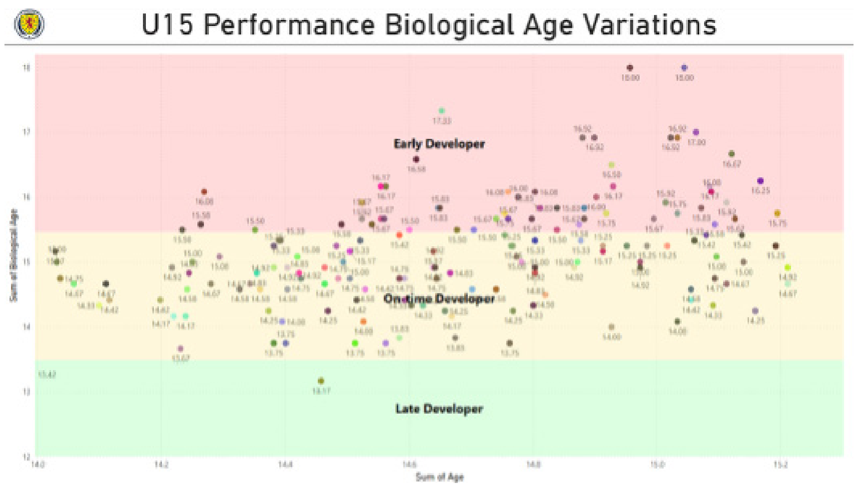
The process of maturation is not linear and the pubertal growth spurt differs across individuals in terms of the age and rate at when it occurs, and the magnitude of the changes that accompany puberty. As such, it's possible to have an entire squad or class of individuals who display varying biological ages, despite being of the same chronological age. The image below highlights every player analysed and identified by biological age variation in the 2009 cohort when they were U15. Essentially what the image above shows is that there is a 5-year biological age variation between our least to most advanced maturing players.

As illustrated in the figure above there is a normal distribution of early, on time and late maturing players in the youngest age groups. This is because the early maturing boys have yet to experience the physical and athletic advantages that accompany puberty. From 12 years, however, the proportions of early maturing boys increase while the numbers of late maturing boys' decrease. This phenomenon is known as a maturity selection bias and can be observed in most professional academies. By 14 years of age no late maturing players are left in the CAS system.



UNCOVER HIDDEN TALENT AND REDUCE INJURIES - Click [HERE] to learn more

WHAT
WHAT IS BIO-BANDING?

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Alongside other interventions, one of the many tools being used by high performance programs to accommodate for individual differences in growth and maturation is "bio-banding". You may have read or heard in the media about many Professional sports clubs using it in their talent development pathways. For example **the Premier League has held a Biobanding festival** and continue to utilise it in the EPP.

The premise of Bio-banding is to create new and more developmentally appropriate challenges for both late AND early-maturing players. This can be achieved by periodically grouping players by their biological rather than their chronological age. This allows older yet late-maturing players, who may be at a disadvantage playing alongisde their same age peers, the opportunity to play against younger yet physically matched players. Bio-banding, also allows early maturing players who may typically possess a physical advantage over lesser mature athletes, the opportunity to experience a higher level of challenge by competing against older and more experienced players with whom they are physically matched.

Essentially, the underpinning principle is to introduce new and more developmentally appropriate challenges and learning environments to stimulate long-term development. This is important as in age group formats early maturers may come to rely on their physical advantages at the expense of their technical, tactical and psychological development, whilst late-maturers may struggle to match the physical prowess of the early maturers.

This **short video** demonstrates the importance and benefits of investing time in Bio-Banding.

HOW

HOW IS BIO-BANDING IMPLEMENTED?

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Firstly, athletes are assessed for biological maturation. This is done without any invasive methods, using a mathematical formula which considers their age, weight, height, and the height of their parents. This formula then predicts the athlete's final adult height and how much of that height they have reached. The formula has a median error of approximately +- 2.2 cm in boys. As discussed in Growth and Maturation in Academy Footballers (Guest Blog: Steve Curnyn - Hibernian FC Academy) - The Athlete Academy, we discussed how the following thresholds are used to separate stages of maturation based on where they sit in relation to Puberty, with Peak Height velocity peaking at around 90-91% of predicted adult height. This important as PHV is considered a time of vulnerability in terms of injury risk. The following thresholds can be used:

1. **Pre-Puberty less than 85% of predicted adult height**
2. **Circa-Puberty 85 – 96% of predicted adult height**
3. **Post-Puberty 96%+ of predicted adult height**

From here, organisations or clubs may choose to hold competitions specifically targeting teams of athletes at a particular stage of maturation outlined above. This will allow athletes to be competing against their maturational peers, reducing the likelihood of disproportionate differences between athletes. HOWEVER, it is not currently recommended that bio-banding replaces traditional chronological age based competition, but that it provides an adjunct to it.

Outside of competition, as described in this video and by Steve Curnyn in his context at Hibernian FC, Bio-banding may not be used only in competition, but as a monitoring tool to measure athlete physical progression, injury risk and load management.

BIO-BANDING FESTIVALS
RUNNING THE EVENT

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TRAINING RECOMMENDATIONS

In preparation for the Bio-banding Festival, it is recommended that players train in the same groupings in which they will be playing. This allows player to better understand the purpose of bio-banding and adapt their game to the new challenges that they will face. Clubs have previously reported that training sessions organised in this way offer even greater insight into individual player development than the festivals alone. Training in bio-banded groups can be used to help players work towards individual goals in the run-up to the festival—for example, later-developing players becoming more assertive or working on leadership qualities, and early-developing players focusing on linking play and tactical awareness. Clubs such as Borussia Dortmund have openly shared that they work in their bio-banded groups every Monday, rather than in chronological age groups, to support individual player development.

We recommend:

- Training for at least one week prior to the festival in bio-banded groups.
- Setting individual targets for players who will not be in their usual chronological age group.
- In future, utilising bio-banded groupings wherever possible to support individual development.

THE FESTIVAL

Using the Khami-Roche method, the Scottish FA collect measurements, compare with WHO growth charts and classify as below, and group the players in preparation for the event.

GROUP 1: 84%-88%

- Pre-PHV band for players that are before the adolescent growth spurt. Players in this band will still have a child like physique and shouldn't have the strength, speed, power physical qualities.

Group 2: 88%-92%

- Circa-PHV band for players that are in the peak of the adolescent growth spurt. Players in this band could be experiencing adolescent awkwardness, appearing clumsy and still not in full control of their body. These players are at most risk of growth-related injuries but could also show flashes of increases in physicality in comparison to group 1 players.

Group 3: 92%-96%

- Post-PHV band for players that are no longer within the peak phase of the adolescent growth spurt. These players will now look more adult like in appearance and can demonstrate more physicality in games regarding strength, speed, power.

PITCH LAYOUT

The example below is how Group 1 (84-88% PHV) would work, this would be repeated for Group 2 (88-92% PHV) and Group 3 (92-96% PHV)

The full 11v11 pitch (100m x 64m) is split into two side-by-side 9v9 pitches:

- **Pitch A:** Left half of the field
- **Pitch B:** Right half of the field

MATCH SCHEDULE – ROUND ROBIN FORMAT - 4 TEAMS

Each team plays 3 matches (one against each other team). Matches last 40 minutes. Two matches run simultaneously on Pitch A and Pitch B.

Depending on pitches and players available, Clubs may run 7v7, 8v8, 9v9 or 11v11.   Adjusting Pitch sizes or game formats may be deliberately aligned to targeted outcomes for players.

TIME	PITCH	MATCH
10:00 AM	Pitch A	Team A vs Team B
10:00 AM	Pitch B	Team C vs Team D
11:00 AM	Pitch A	Team A vs Team C
11:00 AM	Pitch B	Team B vs Team D
12:00 PM	Pitch A	Team A vs Team D
12:00 PM	Pitch B	Team B vs Team C

THE PLAYER EXPERIENCE
CHALLENGE OR COMMAND

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When running events, coaches often use goal setting with players to shape the learning experience for the players. This ensures that each group of players is stretched appropriately — neither too easy nor too overwhelming. Breaking down challenges can often simplify the message by using the 4-corner model of physical, technical, tactical and psychological. These keep the games challenging, fair, and focused on development rather than just winning.

Early Developers - (physically stronger/more mature)
On-Time Developers - (average maturity)
Late Developers - (physically smaller, often disadvantaged in chronological-age tournaments)

PSYCHOLOGICAL

Early *By the end of the festival, demonstrate emotional control by showing resiliency and maintaining composure during 3+ physical challenges or unsuccessful actions without reacting negatively.*

On-Time *Within 3 matches, verbally encourage teammates at least twice per game to build leadership and confidence.*

Late *After each game, write down one positive aspect of personal effort and one area for growth to foster a growth mindset during the festival.*

TECHNICAL

Early *Successfully complete 8 out of 10 passes using weaker foot in match situations by festival end.*

On-Time *Perform 3 different dribbling moves successfully in 2 separate games by the end of the event.*

Late *Maintain ball control under pressure by completing 7 out of 10 successful dribbles in games against physically stronger opponents during the festival.*

TACTICAL

Early *Make at least 2 effective off-the-ball runs contributing to team attacks in each match of the festival.*

On-Time *Demonstrate correct positional awareness by staying within assigned zones for 80% of each game during the festival.*

Late *Anticipate opponent passes to intercept or pressure 3 times per game by festival completion.*

PHYSICAL

Early *Improve agility by completing an agility drill in under 10 seconds during warm-up sessions by the final day of the festival.*

On-Time *Maintain high-intensity runs covering at least 70% of playing time during matches across the festival.*

Late *Demonstrate ability to physically hold off opponent and hold onto the ball for longer periods.*

THE GROWERS CLUB

MODIFIED TRAINING TO MITIGATE INJURIES

The aim of the Growers Club is to mitigate potential growth-related injuries and to provide more playing and training time for both players and coaches throughout the season. This approach utilises growth and maturation assessments to identify when players are at increased risk of time lost due to growth-related injury.

During periods of rapid bone growth, there is increased fragility in the growth plates in the long bones and at the apophyses where muscle tendons attach to the bone. Growth of the skeleton also followsthe pattern from feet to legs to torso— and thus growth related injuries will also typically follow this trend. For example Sever's disease that occurs at the back of the heel will typically present in advance of Osgood-Schlatter's disease which occurs when the tibia experiences its most rapid period of growth.. Our own CAS injury surveillance project found that players are at the highest risk when:

- They are circa-PHV (Peak Height Velocity) 86%–95%, with injuries peaking between 88%–92% of predicted adult height.
- Their growth velocity exceeds 10cm per year. We therefore recommend that players are entered into the Growers Club if they display two out of the following three variables:
- 86%–94% of predicted adult height.
- Growth velocity greater than 8cm/year.
- Experiencing pain or symptoms around a joint.
  What does Growers Club involve?
- Limiting match time to no more than 60 minutes per week.
- Training twice a week, with a third session taking place off-feet.
- Gym-based sessions, focusing on stability and mobility exercises.
- During training, removing the player from drills involving intense acceleration and deceleration.
- For example, not being in the middle during boxes, or being made a 'floater' in small- or medium-sided games.
- The player remains in the Growers Club until the next growth and maturation assessment, at which point their status should be reviewed and the process repeated.

IMPACT
THE LENS OF THE PLAYER

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QUESTIONNAIRE
A simple method to evaluate and gain insight as to the potential benefits of bio-banding is to ask players to complete a simple questionnaire following a tournament. As part of this document, we have included a brief questionnaire designed by researchers at the University of Bath that Premier League academies have used to compare players experiences in bio-banded fixtures in comparison to age-group games. The 20-item questionnaire takes about 5 to 10 minutes to complete and asks players a series of questions about the physical, technical, tactical and psychosocial differences that might exist (or not) between the two formats. What clubs have found is that earlier and later maturing players respond differently to the questions.

Early maturing players tend to report being more physically challenged in bio-banding games, less time on the ball, and having to rely more on their technical and tactical attributes to succeed. In contrast, late maturing players tend report less physical challenge but more time on the ball, and more opportunity to use their physicality and take on leadership roles. The questionnaire also includes three open ended questions where players can provide more insight as to what they did or did not like about the bio-banded fixtures and what could be improved upon in the future.

The feedback generated from these questionnaires can be really valuable in terms of helping you judge the value of this format and improving practice for future tournaments.

The goal of the survey is to assess how this alternative structure impacts player development, enjoyment, and performance compared to traditional age-group games. The questionnaire includes questions related to the following topics and can be found at the end of this document.

PARTICIPANT INFORMATION
Players were asked to provide:
- Date of birth
- Team represented
- Playing position (Goalkeeper, Defender, Midfielder, Forward)

QUANTITATIVE FEEDBACK
Participants rated their bio-banded experience on a scale from 1 (Less/Not at all) to 5 (More/Completely) across 30 dimensions. Key areas included:

Understanding & Enjoyment
- Clarity of bio-banding purpose
- Overall enjoyment compared to age-group games

Physical & Technical Demands
- Injury risk, nervousness, and physical challenge
- Use of technical skills and physical abilities

Learning & Development
- Opportunities to learn, lead, and adapt
- Creativity, decision-making, and tactical awareness

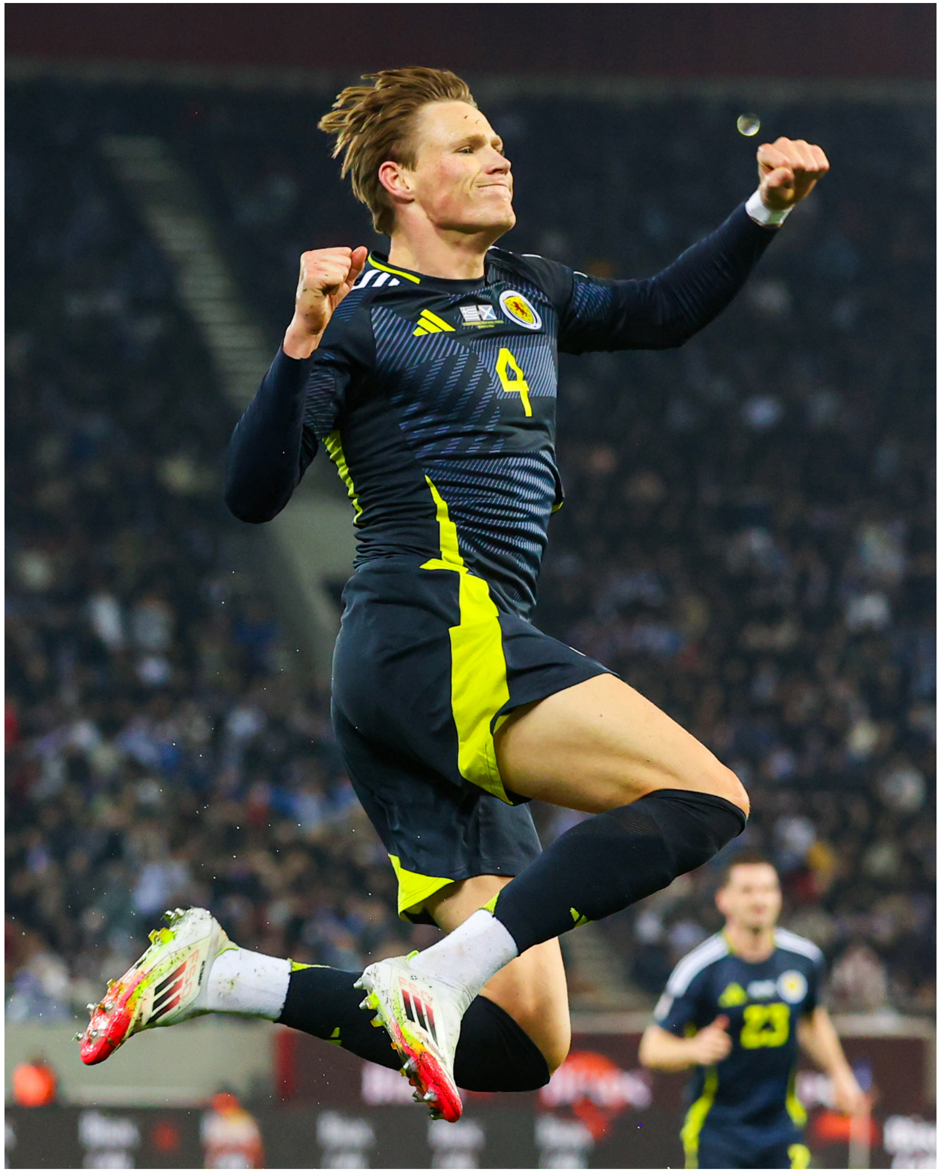
Team Dynamics
- Communication, reliance on teammates, and leadership roles
  Performance & Pressure
- Effort required, pressure to win, and opportunity to excel

Future Preference
- Players were asked whether they would like bio-banded games to become a regular part of their programme

QUALITATIVE FEEDBACK
Three open-ended questions invited players to reflect on their experience:

1. Positive Aspects – What they liked about bio-banded games
2. Negative Aspects – What they didn't like
3. Suggestions – Ideas for improving the format

SUMMARY INSIGHT
This questionnaire provides valuable insights into how bio-banding affects youth footballers' physical, technical, and psychological experiences. The feedback will be used to help clubs, coaches, organisers, and practitioners to refine the format to better support player development and enjoyment.



IMPACT
THE LENS OF THE STAKEHOLDERS

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COACHES
- Understanding of bio-banding principles
- Impact on player development (technical, tactical, physical, psychological)
- Team dynamics and coaching challenges
- Comparison with age-group games
- Observations on player engagement and effort
- Suggestions for improving bio-banded formats

PARENTS
- Awareness and understanding of bio-banding
- Perceived enjoyment and safety of their child
- Changes in confidence, motivation, and social experience
- Concerns or benefits observed
- Willingness to support future participation

CLUB DIRECTORS
- Strategic value of bio-banding
- Alignment with long-term player development goals
- Operational challenges (scheduling, communication, logistics)
- Feedback from staff and families
- Interest in integrating bio-banding into regular programming

SCOUTS
- Effectiveness of bio-banding for talent identification
- Clarity in assessing players' true potential
- Comparison with traditional scouting environments
- Opportunities to observe underrepresented or late-developing talent
- Recommendations for future scouting integration

LIKERT SCALE QUESTIONS (1–5)
Each group would respond to tailored statements such as:
- "I believe bio-banding improves player development."
- "Bio-banded games are more competitive than age-group games."
- "I observed more balanced matchups."
- "I would support bio-banding as a regular part of the programme."

OPEN-ENDED QUESTIONS
- What did you like about the bio-banded format?
- What concerns or challenges did you notice?
- What improvements would you suggest?

OUTCOME
This multi-perspective feedback would provide a holistic view of bio-banding's impact, helping organisers refine the format to better serve players and stakeholders alike.

CONCLUSIONS
MEASURING SUCCESS

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MEASURING SUCCESS OF A BIO-BANDING EVENT
To evaluate the effectiveness of a bio-banding tournament, consider using both quantitative and qualitative metrics across several dimensions:

1. Player Development Indicators
- Skill Utilisation: Did players use more technical, tactical, or creative skills than in age-group games?
- Physical Balance: Were matchups more evenly matched in terms of strength, speed, and size?
- Learning Outcomes: Did players report learning more or facing new challenges?

2. Enjoyment & Engagement
- Player Feedback: Use questionnaires to gauge enjoyment, confidence, and motivation.
- Coach Observations: Were players more engaged, communicative, or adaptable?
- Parent Input: Did parents notice increased enthusiasm or reduced anxiety?

3. Tactical & Psychological Growth
- Decision-Making: Did players have to make quicker or more complex decisions?
- Leadership & Teamwork: Did players take on more responsibility or rely more on teammates?

4. Talent Identification
- Scouting Insights: Were scouts able to identify late-developing or previously overlooked talent?
- Performance Distribution: Was there a broader range of standout players?

5. Operational Success
- Scheduling & Logistics: Were matches well-organised and on time?
- Safety & Welfare: Were injury rates lower or comparable to age-group formats?
- Stakeholder Satisfaction: Did coaches, directors, and parents support future implementation?

Conclusion
Did the bio-banding event demonstrate strong potential as a developmental tool in youth football. Did players report higher levels of enjoyment, increased use of technical and tactical skills, and more balanced physical competition. Did Coaches observed greater engagement and leadership among participants, while scouts noted improved visibility of late-developing talent. Operationally, did the event ran smoothly with positive feedback from all stakeholder groups. These findings support the integration of bio-banding into regular programming, with further refinement to enhance communication, education, and match structure.

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