

# ESPORTS PLAYER DEVELOPMENT

A focus on North American League of Legends by [Parth Naidu](#)

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## ABSTRACT

This paper examines the problems in the development of e-sports athletes from United States and Canada playing professional League of Legends in the League Championship Series (LCS). First, the structure of the Long-Term Athlete Development (LTAD) model developed for traditional sports is studied to understand discrete stages of development and connect them to relevant points in the careers of LCS players beginning with their introduction to League of Legends through their retirement from the game. Specific issues that affect player performance levels and career longevity are then discussed using a new framework called the Player Development Curve (PDC). Finally, recommendations are offered and categorized based on the impact of their applications in the short-term or long-term.

## INTRODUCTION

League of Legends (LoL) is a multiplayer online battle arena (MOBA) developed by Riot Games. In the game, two teams of five players battle in player versus player combat, each team occupying and defending their half of the map. Each of the ten players controls a character, known as a "champion", with unique abilities and differing styles of play. During a match, champions become more powerful by collecting experience points, earning gold, and purchasing items to defeat the opposing team. In the game's main mode, Summoner's Rift, a team wins by pushing through to the enemy base and destroying their "Nexus", a large structure located within.

The game not only has an active player base of more than 100 million average monthly players, but the game is also often cited as the world's largest e-sport, with an international competitive scene composed of 12 leagues. The domestic leagues culminate in the annual League of Legends World Championship. The 2019 championship had over 100 million unique viewers, peaking at a concurrent viewership of 44 million. Domestic and international events have been broadcast on livestreaming websites such as Twitch, YouTube, Bilibili, as well as cable television sports channel ESPN.

One such domestic league is the League Championship Series (LCS) representing North America – more specifically the United States and Canada. While being considered one of the major leagues alongside the LEC (Europe), LPL (China), and LCK (South Korea), the LCS and their representatives have consistently failed to perform at international tournaments despite considerable financial investments from the franchise teams into building their rosters and supporting infrastructure. The LCS organizations have been heavily criticized for importing their players from various regions rather than developing native talent, to the chagrin of other domestic leagues losing their top players to LCS, as well as local players who see fewer opportunities as a result.

The problem that LCS teams face is that unlike traditional sports, League of Legends has barely existed for more than a decade and the traditional models for athlete development such as parental support, high school after-school teams, youth programs, formalized coaching etc. don't exist in a meaningful or interconnected way. There hasn't been enough research done on what factors affect e-sport athlete development for organizations to even know how or where to begin concentrating their efforts. Therefore, to address the criticisms and concerns, we must first create a framework within which we can visualize and discuss player development.

The Player Development Curve (PDC) maps an athlete's average performance level from when they first started playing the game through the course of their career. Its purpose is not to serve as an accurate mathematical model, but rather a simple visual representation highlighting different aspects of an athlete's developmental stages. This paper will refer to the PDC during the and discussion as we examine key factors that impact athletes during the various stages of their engagement with the sport. The average shape of the PDC varies per



e-sport, so for the purposes of this paper, we will be looking at a PDC for a League of Legends player.



**Figure 1** An example of a player's development curve highlighting three different phases in their career. It is implied that some sort of curve fitting is involved to present an average over time.

The training stage of the development curve refers to the period players spend learning the basics of the game, mastering technical skills, and familiarizing themselves with basic strategic and tactical concepts before joining a competitive team. The learning curve for League of Legends is steep. The game has more than 150 playable characters, each with their own unique skillset. Players must start learning how these characters interact with one another in their respective roles in the game. Then, they must learn the basics of the game including how best to earn gold and experience, which items to buy to maximize their champion's utility within each game, and what decisions to make to advance the game alongside their teammates to win. New players must manage all this information while Riot patches and makes changes to champions, items, and rules once every two weeks. Initially players practice against AI to practice basic skills and unlock champions. Then, "normal games" allow players to play against others of a relatively equal skill level in a casual mode. As a player wins or loses games, Riot tracks performance metrics and adjusts who they will play against next to be an appropriate challenge.

The climb to competitive starts with players' journey through the "ranked mode". Unlike the previous modes, this mode gives players a ranking after a 10-game evaluation from Iron (lowest) to Silver, Gold, Platinum, Diamond, Masters, Grandmasters, and Challenger (highest). Players are matched against others based on their match-making rating (MMR) and given points to move up or down through the different ranking tiers based primarily on wins and

losses. Most professional players practice the game on ranked mode and play at the Challenger or Grandmaster level. New players who make it past the Masters rank can try out for or get scouted by professional teams for their academy programs where they learn teamwork, communication, get trained on more tactical knowledge of the game that's necessary to play at a LCS level.

Prior to this, on average most players don't have any formal training or coaching. Everything they learn about the game is self-taught through playing the game, experimentation, watching videos, reading forums, and talking with their peers. Some join local clubs and tournaments, collegiate programs, get individual coaching, but there is very little formalized development plan before the players can hit a certain rank.

The competition stage of the development curve refers to the period between where a player has been scouted and drafted onto a competitive team until their retirement. The most important facets of this part of the PDC are the peak, denoting the highest performance that a player will achieve during their career, and their longevity, or how long can the player sustain the workload to play at a competitive level. Unlike the training stage curve that on average will look similar across athletes, the performance stage will vary heavily depending on the player.

At the academy and LCS level, players receive formal coaching and competition. During the LCS season, players will dedicate at least 4 days per week, 5-8 hours per day in team scrimmages and reviews and an additional 3-6 hours on individual practice that includes reviewing VODs, playing solo queue, and other forms of practice. They will have official matches two days a week during the regular season which amounts to 18 weeks of the year. Players on top teams will compete in playoffs for another 6-8 weeks annually, and a few will attend month-long international competitions in May and October respectively if they qualify. Academy teams follow a similar training regimen and competitive format to the LCS, except for international tournaments.

Most coaching and other support staff are working with players that exist within this part of the PDC curve. When players are initially scouted, their solo queue gameplay and metrics are evaluated for their mechanics and understanding of the game. Amateur and academy programs are made up of mostly inexperienced and limited number of coaching staff. These programs try to emulate the training regimen and style of LCS programs as closely as possible. If players demonstrate a skill level or potential to compete beyond the academy level relative to the existing LCS players and potential imports, they will be presented with opportunities on an LCS team. It is at the LCS level that teams have multiple coaches, including strategic coaches and position coaches that help train players individually. Most additional resources including sports psychologists, physical therapists, data analysts are provided for players at this level to help them achieve a peak level of performance with a focus on physical and mental health to extend the length of their careers by preventing injury and burnout.

The retirement phase of the development curve denotes the period when players no longer have the opportunities or drive to play at the highest level of competition. Some players may choose to play in academy or amateur tournaments as they focus on other aspects of their life.

Some LCS players retire from playing the sport competitively and transition to a career in streaming, broadcasting, or coaching. Others leave the e-sports space completely and follow a traditional path to college or the workforce.

Now that we have defined the PDC within the context of the LCS, we can start asking some important questions. How does the PDC of players developed in North America compare to those who trained in other regions? What factors impact the peak performance levels and longevity of players careers? How does age affect player potential? When is the appropriate time to enter the competition phase? How important are technical skills compared to strategy and tactics for player development? How should these be prioritized and when? These questions are crucial to helping LCS organizations understand how to better identify, train, and promote talent.

The literature review in the following section will look at the Long-Term Athlete Development (LTAD) model from traditional sports to help us expand on this framework and define key developmental stages. This will help identify crucial factors that impact player development and when they can be influenced. We will address the questions above and discuss the relevant factors by projecting their impact on player performance levels and longevity using the PDC. Finally, we will offer recommendations to make the LCS more competitive in the short term and help create a stable ecosystem in the long term.

## LITERATURE REVIEW

This literature review will pull relevant sections and any references they use from the book *Long Term Athlete Development* by Istvan Balyi, Richard Way, and Colin Higgs, published in 2013. They will primarily be unedited to provide the most context possible, before adding commentary on any comparisons and relevance in the esports and specifically, League of Legends player development.

### Introduction to the LTAD Model

Long Term Athlete Development (LTAD) is the planned, systematic and progressive development of individual athletes. LTAD is the answer to one fundamental question: *What needs to be done at each stage of human development to give every child the best chance of engaging in lifelong, health-enhancing physical activity? And for those with talent and drive, the best chance of athletic success?* The LTAD model was developed by Istvan Balyi and Richard Way in order to improve the quality of sport programs so that all participants, including top athletes, could reach their potential. Consider the following shortcomings of the current system of developing athletes as highlighted by Balyi and Way:

#### Poor Training, Practice, and Competition Theories

- In team sports, young athletes over-compete and undertrain.
- Adult training and competition programs are superimposed on developing athletes.
- Training Methods and competition programs designed for male athletes are superimposed on female athletes.
- Preparation is geared toward the short-term outcome (winning) and not toward the process of long-term development.
- Chronological rather than developmental age is used in training and competition planning
- Coaches largely neglect the sensitive periods of accelerated adaption to training.
- Fundamental movement skills and sport skills are either not taught properly or not taught at all.
- The developmental training needs of athletes with disabilities are not well understood.

#### III-Structured Programs

- The most knowledgeable coaches work at the elite level; volunteers coach at the developmental level, where quality, trained coaches are essential.
- Parents are not educated about LTAD.
- In most sports, the competition system interferes with athlete development.
- There are ineffective talent identification (TID) systems.
- There is no integration of school physical education programs, recreational community programs, and elite competitive programs.
- Sports have athletes specialize too early in an attempt to attract and retain participants.

#### Inactive and Unhealthy Lifestyles

- An unhealthy, sedentary lifestyle dominates everyday life.
- People lack knowledge about active and healthy lifestyles.
- People have poor nutritional habits.

#### Limits to Athletic Development

- Poor movement abilities
- Lack of proper fitness
- Poor skill development
- Bad habits developed from a focus on winning
- Children not having fun as they play adult-based programs
- Underdeveloped and unrefined skills as a result of undertraining
- Female athletes not reaching their potential because of inappropriate programs
- Athletes failing to reach their genetic potential and optimal performance level.

#### Ineffective Collaboration and Inefficient Delivery of Programs

- Lack of coordinated policies
- Lack of communication and collaboration among education, health, sport, and recreation
- Failure to reach optimal performance levels in international competitions.
- Athletes pulled in different directions by school, club, and provincial teams because of the structure of competition programs.
- Lack of remedial programs, implemented by provincial and national team coaches, to counteract the shortcomings of athlete preparation
- No systematic development of the next generation of successful international athletes.
- Fluctuating national performances as a result of lack of TID and developmental pathways.

After further examination of the list above, it becomes painfully clear that the majority of issues outlined above are prevalent in the League of Legends competitive ecosystem. We chose the LTAD model for this because the issues it was trying to address for traditional sports at the time of its creation closely align with those we face today in e-sports. In this Literature Review, we will expand on the LTAD model, and then discuss its relevance and implementation within the context of e-sports.

The LTAD model is a seven-stage framework to guide the participation, training, competition, and recovery pathways in sport from infancy through all phases of adulthood.

The seven stages are as follows:

- Active Start
- FUNdamentals
- Learn to Train
- Train to Train
- Train to Compete
- Train to Win

- Active for Life

### Limitations of the LTAD Model

There are many limitations in the application of the LTAD model within the context of e-sports, most notable of which is its focus on physical sports. As a result, it categorizes the stages and offers recommendations connected to corresponding physical development stages. It's likely that the developmental age and corresponding stages for e-sports athletes may be more influenced by cognitive development, rather than physical. Unfortunately, research into the brain and cognitive development is lot less definitive than our understanding of physical development, making it difficult to differentiate the requisite corresponding stages for those of e-sports athletes.

## Active Start

Active start is the first of the seven stages of LTAD. The major objective of this stage of development is to learn fundamental movements and link them together in play and it covers the period from birth to age 6 in both boys and girls. It is a time to instill love of physical activity and should therefore be fun and a regular part of a child's daily life – not something that is structured, required, or forced on the child. Giving children an active start is all about building a better brain during the critical first six years of life.

The phrase "cells that fire together wire together" is relevant here as in any activity (mental or physical), when a movement or thought occurs, some brain and nerve cells "fire" together to make the thought happen or the movement take place. The more the thought occurs, or the more the action happens, the more the cells involved in the thought or action are linked and the easier it is for the thought or action to transpire again. This is important because during the early years of your life, the brain produces millions of new brain cells and billions of synapses between these cells are created. Between the ages of 6 and 11, unused connections between brain cells are eliminated in a process called "synaptic pruning" and only those that are used remain.

Helping children get an active start can come in many different forms – as evidenced by the discovery of mirror neurons. For example, when a child sees someone perform an action and understands the purpose of that action, cells in the child's brain fire in essentially the same pattern as those in the brain of the person performing the action. Mirror neurons help explain how children can learn by watching as well.

The purpose of play during Active Start is to create as many physical-activity controlling brain connections as possible so that the brain learns to control the many kinds of movement that make up the building blocks of physical activity and sport later in life. This is best accomplished by creating the conditions under which young children willingly and eagerly engage in exploratory play that gives them the opportunity for fun, unstructured practice.

Active Start is the first step to "physical literacy" which the LTAD defines as the combination of basic human movements, fundamental movement skills, and fundamental sport skills necessary for engaging in health-enhancing physical activity, the pursuit of excellence in sport, or both. Research shows that without the proper development of physical literacy, children and youth may withdraw from physical activity and sport (Kirk, 2005). In order for people to be physically active later in life, people need to feel confident in activity settings; that confidence in adulthood most often comes from having learned fundamental movement and sport skills as a child (Le Masurier and Corbin, 2006).

For our purposes, while there may be a link between physical literacy and e-sport performance, we are more concerned with "digital literacy". Let's consider each of these ideas presented above in more detail:

1. New brain cells at this age promote opportunity to learn a lot of basic skills. While some children are learning to walk, run, jump, and other basic skills required for

physical activity – they are also pressing keys on a keyboard, clicking on a mouse, and swiping on phones and tablets.

2. The movements or activities that are repeated will create stronger neural links in the brain. The more exposure children have to various digital devices and environments, they will develop fine motor skills that may provide the basis for many foundational skills for e-sports.
3. Synaptic pruning will remove unused or weak connections between brain cells. We need to recognize that the age ranges for developing digital literacy may vary due to differences in brain development for motor skills required for physical sports vs. the fine motor skills that are required here. We can only speculate that children who developed and maintained neural links through the period of synaptic pruning will have a better aptitude for basic skills such as aim, movement, timing, reflexes, and digital spatial intelligence.

Children who have a familiarity with various devices and the understanding of basic gaming skills are going to be more confident and interested in pursuing more opportunities to play video games as they grow older. However, unlike traditional sports which have many pathways via parental support, formal physical education, athletic clubs and more, participation in competitive gaming, especially at an e-sports level is generally an individual pursuit and the self-confidence that digital literacy provides is important to unlock that pathway.



## FUNdamentals

FUNdamentals is the second stage that stresses the importance of learning fundamental movement skills, and in particular, of developing a range of locomotor, body control, and sending and receiving skills, as well as the critical ABCs of athleticism: agility, balance, coordination, and speed. Building on the basic movements of standing, walking, running, the years of 6 to 9 are critical to learn a repertoire of skills that can be adapted and expanded to become fundamental sport skills. For example, a sliding motion that was learned during the Active Start phase can be further developed by learning to slide on skis or skates. Pushing an object can evolve into a basic throwing action which can develop into a basic overhand throw early in the FUNdamentals stage. It's important that children at this time learn a wide variety of fundamental movement skills in order to learn a combination of agility, balance, coordination, and speed in various contexts.

This stage also proposes children learn the various locomotor skills in varied environments including land, water, ice/snow, and air. For example, the fundamental movement skills that need to be developed in water are floating, moving safely through water (swimming), entering the water feet- and headfirst (jumping/diving) etc. These water-based movement skills open up opportunities for competitive swimming, diving, synchronized swimming, and if the child has developed the land-based skills of catching and throwing, water polo. Children who have developed water-based skills are also in a better position to more safely take up activities such as sailing, rowing, canoeing, and kayaking.

While the Active Start stage for most children takes place in homes and community, school physical education plays a large part during this phase because it is the only environment in which all children have the opportunity to develop fundamental movement skills. The best coaches or physical education teachers will continue to create a fun environment that allows children to explore and learn these skills. While a certain percentage of time can be committed to fundamental sport skills or "technical" skills, spending time on strategies or tactics at this stage slows down practices and over-specify roles or positions, creating weaknesses by developing one-sidedness and limiting decision-making opportunities. Any competition during this phase are purely used as evaluation of how the child is progressing on his skills while introducing how the sport is played. The role of parents during this phase is to ensure that their children have ample opportunities for physical activity and encourage healthy eating habits and good amount of quality sleep.

There are many parallels for this stage for the continued development of digital literacy. Children who have been exposed to various digital platforms can now build upon them by applying their knowledge in games. If the ABCs of physical athleticism include agility, balance, coordination and speed, digital finesse includes the basic tenets of aim, movement, and timing. Similarly, to how this stage introduces children to various movement skills within different environments, children can start learning different genres of games including platformers, action-adventure, sandbox, puzzle and party games, and more. Children can learn to navigate 2D and 3D environments on various devices and improve overall dexterity. It's important to note that League of Legends is a game that requires a large amount of technical knowledge from movement, skill shot accuracy, dodging abilities, timing attacks, often simultaneously.

However, these skills are not easy to pick up in isolation by playing League of Legends. We would suspect that the more games and environments that children can play that reinforce foundational skills, the easier it would be for them to eventually start playing League of Legends.

Again, the age ranges for which the FUNdamentals stage applies to children engaging in digital sports will vary. LTAD proposes these stages to align with physical development in children but at this time, there is not enough research done to demonstrate the relative importance and impact of physical and intelligence development on children's learning digital functional skills. We can however predict that cognitive development may play a larger role for digital literacy due to the nature of complex skills and cognitive load required in e-sports. Parents and educators, if they focus on digital literacy at this point, is done mostly as a necessity – and gaming is often treated as a recreational hobby, and often stigmatized. In an ideal world, children would be taught the basics of engaging with different platforms in the same way basics are taught for traditional sports – things like proper posture, the impact of proper mouse speed, how to map keys on a keyboard or controllers for different contexts. In reality, most exposure to games at this stage come haphazardly from parents, siblings, and friends. It is therefore crucial that every player who has had no prior coaching gets evaluated for and given feedback on these basics. Even LCS players demonstrate very little understanding of how posture impacts their long-term health, how they can slowly transition their mouse speed and key mapping to allow them to most efficiently play their respective roles.

## Learn to Train

Learn to Train is the third LTAD stage and one of the most crucial for the development of skills for children between the ages of 9 and 12. At this stage, children are developmentally ready to acquire the general sport skills that are the cornerstones of all athletic development. Children are ready to begin training according to more formalized methods; however, the emphasis should still be on general sport skills suitable to a number of activities rather than excessive single-sport training and competition.

Coaches become more relevant in this stage as children can learn simple strategies and compete in events with growing understanding of the sport's formations. Decision-making skills are developed in this stage as young athletes decide when to use the fundamental skills and how to apply technical skills. In team sports, strategies revolve around offense and defense with an emphasis on spacing, while individual sports, strategies relate to how the event is contested or the sport is played. Despite this introduction to basic strategy, tactics that adjust for opponents is not important at this time – overloading athletes is less relevant than igniting the passion for sport and maintaining a fun atmosphere. At this stage, coaches and parents can start introducing the young athletes to basic skills of relaxation, imagery, goal setting, concentration, communication, and motivation. Competition during Learn to Train is an assessment in overall athleticism including movement skills, sport skills, and in-the-moment decision making in sport contexts.

Let's also consider the topic of specialization at this time. During the Learn to Train phase, many young athletes are beginning to discover which sports they are drawn to or parents might see their child show natural talent in a particular sport may want to specialize early on. Early specialization has been a topic of discussion among relevant members of the sports industry particularly since the success of the former Communist countries at international competitions, especially Olympics, benefitted from a fully aligned sports system that focused on early talent identification, selection, and specialization. However, it was later found that while these efforts resulted in preparing a small amount of world class athletes in a short time-frame, it did so while disregarding negative consequences of athlete health and well-being. Furthermore, it was not efficient at developing the best talent in those countries (Bompa 1995).

Early specialization is defined as one where an athlete starts a sport at an early age, chooses one sport instead of participating in several, training involves focused high-intensity training at an early age, or joins the competitive sport early. The timing of specialization is important because:

- Participants must be ready on many levels (physically, mentally, emotionally, and cognitively) to specialize in one sport.
- Athleticism must be developed before sport-specific technical, tactical, and physical development.
- Athletes need a wide range of sport abilities that they can transfer from one sport to another.
- Specialization that is correctly timed can prevent burnout, loss of interest, and overuse injuries.

Cote, Lidor and Hackfort (2009) argue that early diversification enhances athlete development, whereas early specialization hinders it. They identified that:

- Early diversification does not hinder elite participation in sports in which peak performance is reached after maturation
- Early diversification is linked to a longer sport career and has positive implications for long-term sport involvement.
- Early diversification results in participation in a range of contexts that promote positive youth development.
- A lot of deliberate play during the sampling years establishes a range of motor and cognitive experiences that children can ultimately bring to their principal sports of interest.

Balyi and Way further point out that youth who try a number of sports and specialize at older ages reach higher performance levels than those who specialize early. Such athletes are less likely to burn out and do not develop the perfectionist attitudes that often come with early specialization. They develop better movement patterns and decision-making skills because they are involved in a range of activities that require a variety of cognitive and physical functions.

Many successful League of Legends players today have talked about their past interest in a variety of different games as they were growing up, and even play other games recreationally during their professional career. It's also interesting to note that these players who had diverse gaming experiences as children also achieved high performance ranks in those other games before choosing to specialize in League of Legends.

Delving more specifically into competitive League of Legends – there are five distinct roles in the game. Once players choose a specific role, they need to learn very specific champions, gameplay mechanics, and communication standards to reach a degree of proficiency at the role in order to play at a competitive level. One large problem here is that due to lack of coaches at a developmental level, players choose their primary role for illogical reasons – some of which include:

- My favorite e-sports player plays this role
- My group of friends needed me to play this role
- I liked this role/I was drawn to this role because of [reasons unrelated to skillset]

Furthermore, most players choose to forego learning or playing the other roles and specialize early so that they can achieve a higher ranking than if they diversified. Some players even go as far as specializing in one or two champions.

Balyi and Way point out that this is the stage where parents and inexperienced coaches can make mistakes in training. The "winning" coaches in this stage lead their young charges to lopsided victories in undefeated seasons. These coaches recruit players to ensure that the best ones are on their teams, and then devise strategies and tactics to minimize the players' weaknesses and maximize their strengths. This ensures that the players avoid risk-taking and follow the systems prescribed by their coaches, believing that winning is paramount.

Unfortunately, parents encourage this type of coach because they also revel in the winning. They do not realize that their children are learning a limited range of skills within the specific positions or roles they are assigned. Typically, these coaches put players in the same positions, do not encourage them to take chances or experiment, and are noticeably agitated when the players are not winning. Such coaches limit players' decision-making opportunities and their ability to read the activity from multiple perspectives, resulting in limited cognitive development. At this stage, creativity should be encouraged. Although being innovative often results in mistakes, parents and coaches must take care that learning is not sacrificed for the sake of winning.

As previously discussed, on average League of Legends players have received very little coaching as they learn the game through playing the game themselves, talking to friends and siblings, online forums etc. Amateur programs recruit players straight from solo queue and fall into the same traps that Balyi and Way point out. Coaches and organizations recruit players to ensure that the best ones are on their teams and then devise strategies and tactics to minimize the players' weaknesses and maximize their strengths. This is a type of specialization that is induced by coaches. Players, in their key developmental stage are foregoing technical skill development as well as the ability to explore different styles and contexts of play in order to win. The success of these programs is often defined by their win rate and inflated player statistics on winning teams at this level is conflated with a well-developed player ready to move up to the LCS level, when the truth is far from it. Usually, young players who win academy utilizing these methods find that their tactics don't work against players in LCS who have a more robust technical skillset and more experience. However, these players at the LCS level must win and have less time to focus on technical skills and have to continue using tactics, hurting their careers in the long term. This idea that winning at an academy or amateur level is correlated to success has permeated every level of the North American League of Legends ecosystem, often at the expense of the development of talented individuals because it has led organizations to build teams, coaches to tailor their methodology, and players to train in a way to maximize their win rate in solo queue, scrims and matches, rather than developing well-rounded athletes.

If players are getting their first coaching at an amateur or academy level, their coaches need to do a thorough examination of their technical skills and their understanding of the game. It is likely that players while self-training have missed key skills or have limited knowledge of multiple relevant classes to their role or even the game. This well-rounded education and acquisition of some level of mastery over the relevant skillset is paramount before delving into more advanced team strategy or tactics and even then, players should be encouraged to continue refining their technical skills through 1-on-1 coaching, well-defined solo queue goals, and opportunities in practice to assess competence.

## Train to Train

Train to train is the LTAD stage at which people are physiologically responsive to stimuli and training. The goals for athletes at this stage are to strengthen and refine basic skills in the sports they play as well as to develop alternatives to these basic skills while acquiring new ones. Athletes consolidate basic practical tactical knowledge, and coaches tailor new tactical knowledge to match the performance of each athlete. Decision-making skills continue to develop, and athletes are developing solid general physical foundations of speed, strength, endurance, and flexibility.

This is the first stage in which tactics are introduced to athletes to adjust to opposition's approach. These tactics support intuition (game sense) that has already developed in previous stages. Athletes look to further develop their skills and understand how to properly execute set plays. Repetition in practice is important at this stage so that execution becomes reliable. Many hours of formal training are required, along with opportunities to apply the skills in practice and competitive settings. Additionally, athletes are introduced to psychological techniques of self-talk and thought stopping that work together to create a positive state of mind for athletes to ensure their best performance and enjoyment of sport. More specific goal setting at this stage can help athletes track what they need to work on and their progress.

An important aspect of this stage (as it takes place while athletes are going through puberty) is that while athletes are experiencing rapid, physical changes, they are also being exposed to increased workloads. Athletes at this stage have the highest chance of experiencing overtraining, overuse, and burnout. It's important to teach athletes to keep records of their training loads and response to stress. Tracking heart rate, quality of sleep, and fatigue levels, if recorded daily can start teaching athletes to listen to their bodies.

These goals of this stage align with an ideally run academy-level program in the North American League of Legends competitive ecosystem. Players move to Los Angeles and work together and in-person with their teammates and coaching staff for the first time. They follow a schedule and an intensive training regimen for the first time. At this level, everyone is expected a certain amount of competence in their role and to be mastering the basic skills of the game. Coaches focus their time on team-oriented strategies and communication skills at this level. The players compete in official matches twice a week, and those performances allow the coaches to refine tactics and address strategic and skill deficiencies within players. Outside of playing the game and formal reviews, players are taught to study VODs and hone individual skills in solo queue.

Since the coaching resources at this level are limited, most coaches focus on team reviews, specifically discipline and strategic knowledge of the game. Players are left to manage their own development – including learning the specifics of their individual role, learning and maintaining skill at utilizing new champions as the metagame dictates. Since, there is also a great emphasis placed on winning, if players lack technical skills or fundamental sport skills at this stage, coaches devise team strategies to minimize the impact on the team, rather than help players expand their skillset. Few organizations have resources in place at this level to teach

the importance of or techniques for managing physical and mental health associated with the sudden increase in volume and intensity of training.

In an ideal case, training at the academy level should also be about helping players acclimate to what training at a professional level looks like. Coaches should have a good background on cognitive load theory and how it applies to daily training. Periodization basics should also be applied to their training regimen since the schedule for academy is rigid. Unlike LCS that has to focus on tactics and changes to patch at a micro-level, academy can be fluid in their responses to patches – opting instead on focusing on technical skill and team strategy and communication, which means they can plan out ahead of time at what volume and intensity of training will look like at various points during the season. Finally, players should be taught the fundamentals of self-training. There is no standardization, even at the LCS level for how to watch VODs or other players, how best to train in solo queue, how to learn to optimize builds. Academy is the best time to educate players on these skills outside of game so that they can more efficiently utilize them at the LCS level.

## Train to Compete

Train to Compete stage of LTAD is primarily focused on optimizing physical preparation. Over the course of this broad and open-ended stage, the emphasis moves to a repetitive sequence of (1) prepare to compete, (2) execute the rehearsed and required performance, (3) recover, (4) review the performance, and (5) modify the training and competition plan. This time is for further developing sport, individual, event, or position-specific skills with help from a sport science and sports medicine support team. A basic tenet is that this developmental stage is as much about training, learning, improving, and executing a practiced behavior in competition as it is about the competition result.

Athletes at this stage have a serious commitment to the pursuit of a goal. The allocation of resources from all involved in the process increases markedly and becomes more focused. This stage begins to lay out a clear multiyear vision with objectives across a number of categories outside of performance outcomes (technical execution and decision making under pressure, improvements in underlying physical attributes etc.) This vision, a multiyear plan, is reviewed, modified, and improved with greater clarity as time progresses.

Critical aspects and characteristics of this stage are identified here:

- Further development of technical, tactical, and performance, or playing, skills.
- Increasing level of specialization (sport, position, discipline, event)
- Modeling and relentless rehearsal of all aspects of training and performance, particularly the execution of required skills under a variety of conditions
- Integrated recovery and regeneration practices and periods as part of the training and competition process
- Attention paid to maximizing ancillary capacities and the education of the athlete
- Ever-increasing level of program individualization
- Sport-specific training (technical, tactical, and physical conditioning related)
- Shift toward a more competition-based focus: broadly, 40% of available time to the development of technical and tactical skills and improving underlying fitness, and 60% allocated to competition and competition-specific training
- Performance targets established according to a long-term plan based on a firm understanding of both the developmental performance level of the sport and the athlete's career path

The significant difference between skill development in this stage compared to prior stages is that athletes refine their skills under increasing pressure as the speed and level of competition increases and the consequence of winning or losing can mean either more or less prestige, money, or media attention. At this stage, athletes should be refining their personal mental training techniques, developing consistency, and tracking performance. In terms of recovery and regeneration, athletes should be periodizing main recovery routines into the athlete's training program and managing fatigue effectively with the help of yoga, meditation, massages etc.

At the LCS level, the resources invested into coaching staff increase dramatically. On average, each team has one head coach, one assistant coach, one strategic coach, and at least one



analyst. The head coach is responsible for the sequence consisting of (1) prepare to compete, (2) execute the rehearsed and required performance, (3) recover, (4) review the performance, and (5) modify the training and competition plan. In a general schedule, the team will prepare to compete towards the end of the training week – on Thursdays and Fridays as they consolidate their champion pools and compositions. There are meetings either the night prior or morning of each match on Saturday and Sunday to focus on tactics and opposition prep. Mondays are rest days, free from practice, although they can sometimes be used for sponsor shoots etc. Players are still expected to keep up with individual practice in solo queue during this day as they recover. Coaching staff and players review their performances either directly following the performance or at the start of the next practice week on Tuesdays. The early days of the practice week, Tuesdays and Wednesdays, are focused on adjusting training goals and preparing new champions or compositions for the following matches.

It is assumed that the players are experts at their own role and the individual skill development is left to them. While the coaching staff on each team have a variety of responsibilities, they are generally more focused on strategy and tactics. Most teams will not keep records tracking players performance or health throughout the year, often making it harder to gauge these elements objectively at the end of the split or year when exchanging feedback or deciding on changes. At this level of competition, there is a high level of fan engagement on social media throughout the season, and particularly after each match. Players and staff are often encouraged to interact with their fans to build their brands, most times without the proper media training or learning how to manage relationships within these mediums. Sports psychologists or other mental health professionals and physical trainers and therapists are also readily available at this level for the players; however, their level and frequency of participation are usually on a case-by-case basis, rather than a structural fixture with a consistent methodology for each player. The efficacy of each of these programs vary per team and are rarely integrated efficiently with coaching staff and practice.

## Train to Win

Train to Win stage evolves from Train to Compete, the shift not being a clearly defined point in time. The Train to Win stage can be broken down into two seamlessly linked phases: (1) a mastery period of world-class performances, podium performances, or finals performances and (2) the stabilization period in which the athlete maintains this performance level (or a level close to it). The overall yearly volume for systematic training during this stage typically spans to 800 to 1400 hours. A peak occurs in the early to middle years of this stage, and a gradual decline to approximately 1000 hours occurs as the stage moves to conclusion.

There are few key distinctions between this stage and the prior. First, athletes in this stage are targeting and competing in major events: Olympics, world championships, World cup tours etc. Second, in terms of skill development, tactics take precedence while the other three skills – fundamental movement skills, sport technical skills, and strategies – are generally balanced during training and competition. Athletes know their opponents' strengths and weaknesses as they vie for podium performances. The saying "It's 90 percent mental" applies to athletes at this stage. Their fitness preparation is maximized and skills are refined, so reacting well tactically to a situation is the variable that can result in a competitive advantage. Experience under the greatest conditions of pressure and performance allows athletes to challenge themselves at their optimal limits as they continue to perfect every aspect of their skills so they can create peak performance on demand. With regards to competition, generally only 25% of time in the sport should be spent in training or practice, and 75% of the time should be spent on competition. The key aspect of this stage for athletes is to recognize that one's chosen sport encompasses all aspects of one's life.

Translating this into the context of competitive League of Legends, this stage applies to those players who consistently place highly in regional playoffs and attend international competitions such as the Mid-Summer Invitational and the World Championships. It is at this level of competition where players and teams all demonstrate high level of mastery in game knowledge, mechanical ability, depth of champion pool, and team coordination, that tactics – specialized planning based on studying opponents – becomes crucial. It is at this level of competition where players learn to perform under extreme pressure and those with experience can help lead their teammates. While attending these competitions, scrimmages and other forms of training are focused mostly on specific strategies and tactics in preparation for the match.

Normalizing for skill level, the success of athletes at this stage will be largely influenced by the composition of their training programs. When attending MSI and World Championships, there is generally a change in the patch where it's important to discover the new optimal game state for the competitive level. At the same time, teams will be scrimmaging against their opponents at the tournament, giving each teams easy access to study their opponents and prepare appropriate counter-strategies for when they play on stage. Finally, playoffs and international tournaments take place over the course of 3-4 weeks, before which teams generally bootcamp. Periodization is crucial by adjusting practice volume throughout the bootcamp and event for the players on the team to peak at the right time. This would be best done in consultation with physical and mental health staff that is working with the players on the team

during this time. It is hard to tell the relative efficacy of the coaching staff of LCS teams attending these tournaments compared to their European, Chinese, and Korean counterparts, but the tournament organizers limit the number of support staff that can attend, making it an additional challenge for teams who often have to make do without important resources while preparing for the most important matches of the year.

With regards to player development, international tournaments not only give tactical experience for the players who are able to attend, but if the tournament is hosted by another major region - Europe, China, or Korea, players also have an opportunity to play solo queue against a set of players who on average have a higher technical skill level and can help players refine their own. Since most team training at the LCS level focuses on strategy and tactics and players are left to focus on their own technical skill training in solo queue, the average level of players that they face in solo queue determines how efficiently players can refine and learn skills. An opportunity for especially NA players to go abroad and experience a more efficient training environment will allow them to develop further and bring that level back to the LCS after the tournament.

## Active for Life

Active for Life is a unique stage in the LTAD model that is guided by five primary actions: retaining participants in sport and physical activity for life; motivating less active or sedentary people to participate in physical activity, transitioning highly competitive athletes into more involvement-based roles, facilitating continued participation as children become youths, and recruiting, developing, and retaining sport and physical activity leaders. The premise behind this stage is that not everyone wants or is able to compete at the highest level, but everyone benefits from healthy, lifelong involvement in sport and physical activity. After physical literacy is developed, there are a lot of different pathways that don't include the competitive track.

The Active for Life stage contains three streams, two that are participant based and one that is leadership based.

### Participant Based

- Competitive for Life – This stream includes participation in sports for the love of the game and includes recreational league play through championship competitions. It does not include athletes who are still in the excellence pathway striving for Olympic glory or professional contracts.
- Fit for Life – This stream includes all physical activities such as hiking, gardening, yoga, aerobics, skiing, and walking, as well as nonorganized sports such as pickup games in the schoolyard or park.

### Leadership Based

- Sport and physical activity leaders – This stream is about contributors who enable sport and physical activity to take place.

Looking at specifically the sport and activity leaders, opportunities to be active for life can include:

- Coaching and Instructing
- Officiating
- Administrating (volunteer and professional)
- Working in sport science or sports medicine

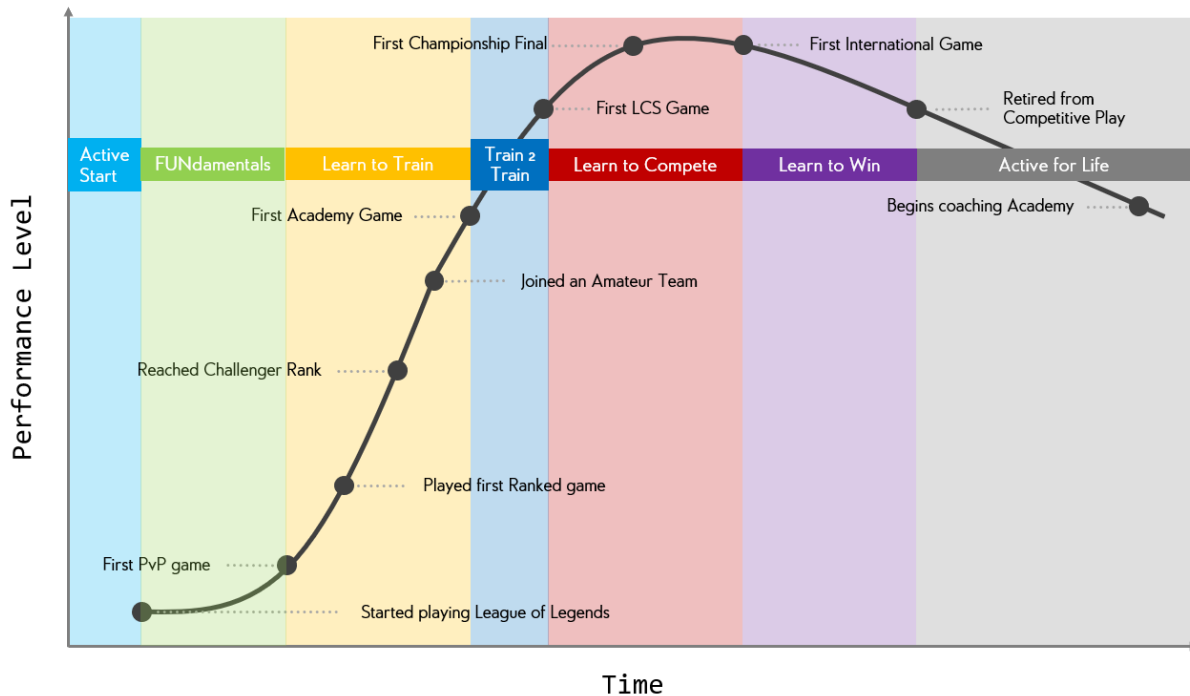
The quality of a sport or physical activity depends on the quality of the person leading it. Developing successful, quality coaches and instructors is an ongoing challenge for countries, many of which have designed, implemented, revised, and abandoned various methods of training coaches, resulting in a wide range of training and instructional approaches to coaching certification. The optimal model for Long-Term Coaching Development (LTCD) starts when people are still active athletes, since the manner in which they are coached influences their competency to coach later in life.

The most challenging aspect of player development in competitive League of Legends and e-sports in general is that since the industry is so young, there is a distinct lack of good coaches

for at all levels. The current model in e-sports considers and values players solely on their ability to play whether it be a young player who is trying to reach for academy or amateur level or an athlete at the tail end of their careers. It is rare that they are offered alternative paths to participate in the ecosystem, partially due to lack of interest on their end, but mostly due to lack of established coach training platforms and funding to create or invest in them – despite it being universally agreed upon that adequate coaching is hard to find. Additionally, there is going to be an increasing percentage of adults in the following generations that grew up playing and following e-sports, however most of the recreational programs and leagues cater to mostly young players. Giving adults a lifelong path to participate in e-sports will make e-sports accessible for the following generations which is important for the sustainability of the game.

## DISCUSSION

This is the superposition of the LTAD model onto the Player Development Curve (PDC) introduced earlier. For clarity, this is only one example of what a PDC for an LCS player could look like. The curve itself is also an average of discrete points during the career. In reality, players would experience many small dips and peaks throughout the year, plateaus that they need to overcome etc.



**Figure 2** The LTAD stages superimposed on the sample Player Development Curve

A brief summary of each stage for this player:

1. **Active Start:** Takes place at a young age when player is introduced to PC gaming. The player is already somewhat familiar with keyboard and mouse controls as well as basic skills such as timing and aim.
2. **FUNdamentals:** Player starts to learn the basic rules of the game and starts to piece together how champions interact with each other, what items to build, how to gain experience and gold, etc. At this point, the player is playing in low stakes games (vs AI) or modes with friends.
3. **Learn to Train:** Player starts to play the game seriously against other players and eventually in Ranked mode for a more competitive environment. At this stage, the player is developing his technical skills against opponents and learning about various strategic and tactical elements in the game that can be utilized at an individual level.
4. **Train to Train:** Player joins a semi-professional team and further refines technical skill and is introduced to communication and strategy elements in a team setting. Player

works with a coaching staff, gets acclimated to competitive training and match schedules, and learns to optimize individual training regimen.

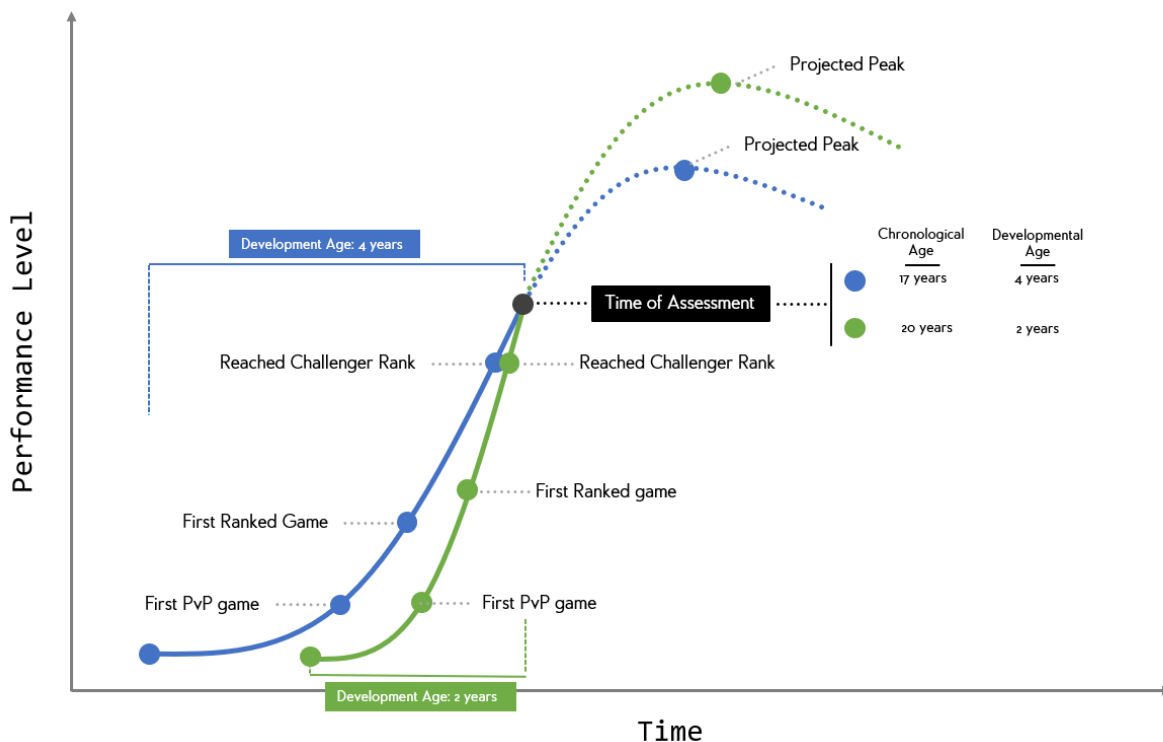
5. Train to Compete: Player joins a professional team and optimizes training to balance development and performance. Player is surrounded by a host of support staff at this level including coaches, sports psychologists, physical trainers etc. to help players focus on the game. Tactical skill is developed at this level, especially during playoffs and beyond.
6. Train to Win: Player consistently achieves high playoff runs and participates at World Championships, developing tactical experience and a level of strategic depth to their play. Player prioritizes training tactical sense while maintaining a regimen to upkeep team strategy and technical skills.
7. Active for Life: Player retires from professional play due to lack of drive or opportunities. Player can then opt to continue competing at a semi-pro or amateur level, pursue coaching or similar positions at organizations supporting the league, or transition to a broadcaster, streamer, analyst, writer and other tangential positions.

In the upcoming pages, we will discuss a variety of factors that impact player development and map how they would affect a players' careers, notably the peak potential and longevity utilizing the PDC including:

- Development Age
- Digital Literacy
- Specialization
- Playerbase Discrepancy
- Cognitive Load
- Periodization
- Competitive Schedule
- Generational Confluence

## Development Age

Chronological age simply accounts for how much time has passed since the individual's date of birth. Coaches, scouts, and other relevant members unfortunately use it to subconsciously categorize players and conflate age and perceived level of training and cognitive development. For example, if two players attend tryouts whose skillset and performance are similar, the player who is younger of the two will be perceived to have higher potential because they demonstrated equal mastery at an earlier age. Development Age accounts for a player's physical, emotional, and cognitive maturity levels as well as their technical training. In the previous example, it's possible that the older player used to play other games and only transitioned to League of Legends recently and is still developing his skillset whereas the younger player has been playing the role he specialized in since the age of 14. Therefore, it is possible that the older player to be equally or more valuable as a prospect. The development age in combination with the LTAD, provides a more accurate picture of how to categorize players and where to focus their development.



**Figure 3** Two PDCs of players with different chronological and developmental ages that show an equal performance level at the time of assessment.

Proponents of chronological age may argue that a player's career is limited and that players hit their peak around a certain average age after which, their performance begins to decline. However, it's important to note that at this time, there has been no definitive research that has shown this to be the case. Robert Yip tackles this issue in his paper "Esports Performance and Aging" and argues that there are no significant age-related physiological declines in fine motor control or cognitive performance. He argues that the effects are due to possible socio-psychological effects, environmental factors, risk assessment/performance compensation, and

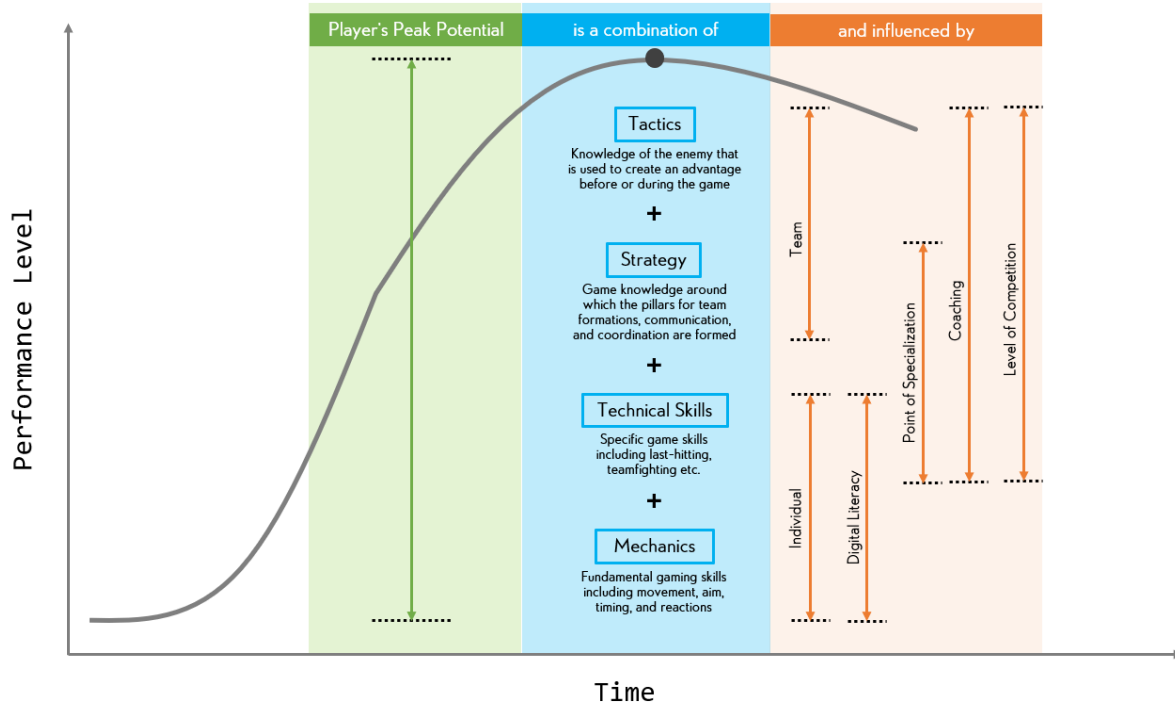


motivation or life priorities – all which can be addressed through proper health and wellness programs.

A player's performance level depends on a few major factors – raw mechanical ability, technical skills, strategic knowledge, and tactics. Mechanical ability is a commonly used misnomer in the League of Legends competitive industry to denote how fast a player can process information and respond to stimuli with the proper combination of mouse movement, mouse clicks and pressing keys on a keyboard to move, aim, and utilize skills. Presently, it's commonly assumed that this is a player's raw innate ability that most likely cannot be easily coached or trained. Technical skills are the standard maneuvers within the game such as last-hitting, attack-moving, animation cancelling etc. as well as mastering various champions and class skillsets and playstyles that while conceptually may exist in other games, but functionally need to be trained in League of Legends to master the proper movement, aim, and timing required to consistently perform them. Strategic knowledge is the general understanding of the game, how team compositions function, which objectives to prioritize and overall win conditions. These are concepts that are drilled during practice and reviews as they tie the team together in how they should play the game. Tactical skills are the decisions and actions players use to gain an advantage over an opponent either through preparation or responding to opponent's specific actions during a match. These can be prepared but are harder to train – especially those that aren't prepared. The difference between a strategist and a tactician is that a strategist can lead a team through well-rehearsed steps, while a tactician leads a team in response to enemy movement and plans. It's much easier to train a strategist than it is to train a tactician.

When assessing players during tryouts or watching their VODs, it's important for scouts to categorize player in-game performance to these factors to know how to onboard them appropriately. For example, if two players with similar performance metrics are being compared for academy or amateur positions, innate ability and aptitude for tactics are important since technical skills and strategic knowledge can be trained/taught depending on the allotted development timeframe. This is not to say that strategic knowledge and technical skills aren't important, but rather those scoring highly in those categories may imply that the player is further along their development curve and their performance should be compared against more experienced players to make a better estimate of that player's potential.

## Peak Potential



**Figure 4** The various factors and influences that affect a player's peak potential in the PDC

A player's peak potential or performance level is dependent on a combination of their innate ability and mechanics, their technical skills, their understanding of strategy of tactics. In the following sections, we will consider various factors that influence these key abilities such as digital literacy, point of specialization, coaching, and level of competition. Digital literacy for example can influence a player's aptitude towards the game and allows them to learn technical skills at a faster rate. Point of specialization can influence the amount of technical skill and strategy a player has learned before choosing a primary role while coaching can help players refine both as well as help with tactics. Finally, the level of competition will be examined as a result of the difference in player bases in North America and the other major regions.

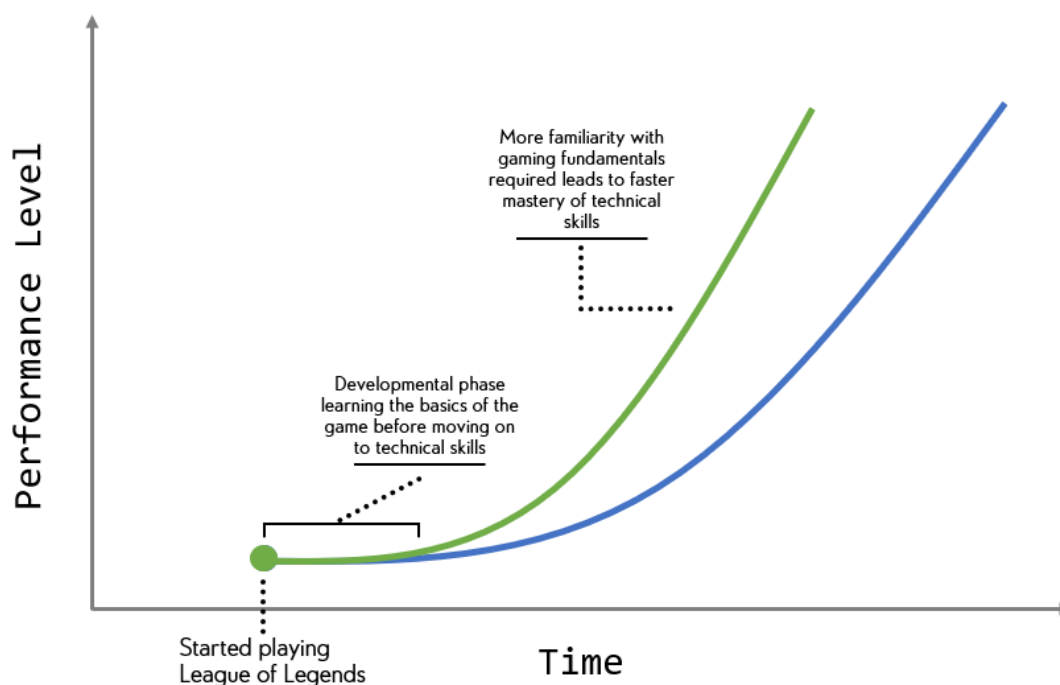
## Digital Literacy

LTAD defines physical literacy as the combination of basic human movements, fundamental movement skills, and fundamental sport skills necessary for engaging in health-enhancing physical activity, the pursuit of excellence in sport, or both. Digital literacy is to e-sports as physical literacy is to traditional sports.

LTAD Stage	Physical Literacy	Digital Literacy	Comments
Active Start	Walking, Running, Gripping, Pushing, Sliding	Pressing keys and buttons on keyboards and controllers, rotating joysticks, clicking and moving mouse, swiping and touching tablets and phones	Active start for digital literacy involves children's development of fine motor skills
FUNDamentals	Advanced Skills: Swinging, Throwing, Catching, Skating, Kicking, Climbing, Dribbling Exposure to Environments: Water – Floating, Diving Snow – Sliding	Foundational Skills: Moving, Aiming, Timing, Dodging, Input Combinations, Rotating Camera Exposure to Different Viewpoints: First-person, third-person, 2D and 3D Environments, Isometric Views	Utilizing inputs to manipulate objects on screen and learn to visualize different digital environments and point of views
Learn to Train	Introduction to basic rules for a variety of sports: Baseball, Basketball, Football, Soccer, Swimming, Water Polo, Skiing, Ice Skating, Gymnastics	Introduction to simple games in a variety of different genres: Platformers, Puzzle Games, Action-Adventure, Sports, Strategy, Sandbox, Fighting, Shooters	Introducing basic games in various genres to increase familiarity and develop foundational skills

At some point in their development, all e-sports athletes had to learn how to use their respective devices – keyboard and mouse for PC, controllers for consoles, phones and tablets for mobile (and potentially VR in the future). Most then learned how to use these devices in the context of gaming. Some basic gaming skills include aiming, moving, dodging, using abilities, rotating camera and more. These skills are expressed differently based on the device used to play the game, and the type of game it is. For example, aiming an ability with a controller in a 2D platformer will differ drastically than using a mouse in a 3D shooter. If children or young adults aren't exposed to a particular device, fundamental skillset or genre

during their formative years, their engagement rate for those gaming contexts decreases in the future due to lack of familiarity or feeling of competence and self-esteem.



**Figure 5** The early phase of the PDCs of two players with different levels of digital literacy

A broad exposure range not only provides multiple pathways for youth who have the talent and want to pursue a competitive career in e-sports, it's possible that critical neural wiring that occurs for fine motor skills, visual processing, multitasking, and a host of other relevant skills when exposed to a variety of games, environments, and devices will create a stronger baseline for an individual's competitive game of choice. For example, a player familiar with shooters when growing up who then specializes in a MOBA such as League of Legends may have a higher aptitude for aiming abilities and camera movement than the average player. Especially for a game such as League of Legends that involves learning a lot of different fundamental skills that are difficult to master by simply playing the game since one has to focus on learning the rules of the game which are already complicated by themselves, experience in various other games played on the PC is most likely going to give a stronger base skillset to build upon than having League of Legends be the first PC game experience. The figure below shows the beginning of the PDC for two players, one with a more complete foundation of digital literacy than the other. That player can learn the basics of the game and master technical skills at a faster rate. While a genetic component could be relevant in this level of aptitude, it's equally possible that digital literacy at a young age contributes just as much if not more. This can have a snowballing affect on player development as this player can in an equal timeframe learn technical skills from a variety of roles, ultimately increasing his level of peak performance once the player chooses their specialized role.

Since there are no formal coaches and school programs that expose players to gaming as part of the extracurriculars are rare, it is currently up to the parents to give children the resources and the time/space to explore these digital environments. It is only by increasing the digital literacy rate amongst the youth that you can expect an increase in participation in esports and gaming and higher performance peaks in e-sports athletes.

## Specialization

While the previous section explores the potential advantages of diverse experiences in various gaming contexts during the formative years, let's now explore League of Legends specifically. League of Legends is a complicated game with a steep learning curve due to the game knowledge and technical skillset that needs to be developed together to reach higher levels of proficiency.

The game has 150+ champions each with at least four unique abilities that deal damage, affect movement, help allies, deter enemies, change terrain, and more. These champions can be categorized into classes based on their basic attributes and abilities such as fighter, mage, marksman, tank etc. Each team of five players are separated into a role they play in the game – Top, Mid, ADC, Jungle, and Support. There are 175+ items for purchase to increase basic attributes and give additional abilities and bonuses to the champion. Each champion, class, and role has its own set of technical skills that players have to learn in order to optimize their impact. In general, champion movement, aiming and timing abilities and auto-attacks, and optimal skill combinations vary per champion.

A champion like Ahri is a mage/assassin that specializes in ranged skill shots needs to learn how to use her abilities to dash around her opponents to aim at high priority targets and deal the most damage, whereas a champion like Ashe is a marksman who deals damage with her auto-attacks and slows and stuns enemies has very poor movement abilities and needs to mind her positioning during skirmishes, and attack-move, a skill where the champion moves between each individual attack to reposition and dodge. Each role in the game has its own relevant skillset due to their position on the map. A top lane will share their lane against the enemy top lane as they look to kill enemy minions to gain gold/exp while harassing the enemy and preventing them from doing the same. A top lane player must be proficient at last-hitting (timing the final blow to an enemy minion before an allied minion can kill it) in order to gain that gold/exp, while constantly repositioning and attacking or defending against the enemy player. Meanwhile, a jungler will spend his time killing AI monsters scattered across the map and has the ability to influence the other lanes with his presence temporarily. As a result, jungle players need to be more proficient at processing information from around the map by consulting the mini-map and constantly looking at the different lanes.

This doesn't include the runes, summoner spells, and variety of in-game buffs that can re-shape how your champion can be optimized in the various roles or classes. The sheer number of choices can be overwhelming so it's natural when players first start playing League of Legends, they focus on mastering one champion or a small subset of champions in one role as they learn the nuances of the game itself because unlike unstructured or developmental

leagues via high school and community programs that distinguish between practice and competition, each game of League of Legends ends in a victory or defeat which incentivizes players to adjust their choices in order to win. The critical problem at early stages of a players' journey in League of Legends is that there are few ways to learn the technical skills required individually to be broadly proficient at the game outside of playing a full game. This level of early specialization can be dangerous and lead to some of the following problems:

1. Players don't have a broader perspective and are worse than other players in the same role when normalized for aptitude.
2. Players can't swap roles due to lack of foundational skill outside of their specialized role and can experience burnout or loss of interest.

Consider a player who specializes in the jungle role early on and doesn't fully learn the fundamentals of the other role or classes. They may not be able to recognize lane states or what the specific lanes need to prioritize their movements across the map accordingly. In skirmishes against the enemy team, a jungler who doesn't understand where his teammates need to position or what they need in particular situations will make worse decisions during these encounters – things that are intuitively easier if the player has the context or perspectives of the other champions or classes. As Riot patches the game every two weeks, players with less knowledge of the game will take longer to adapt to changes than those who can connect the changes across the wider scope of the game. A few years after specialization, the player begins hitting diminishing returns in their performance increases. It's possible they don't enjoy the game. They don't have enough functional knowledge of other roles to play them at the same level and it would take them too long to swap while maintaining their

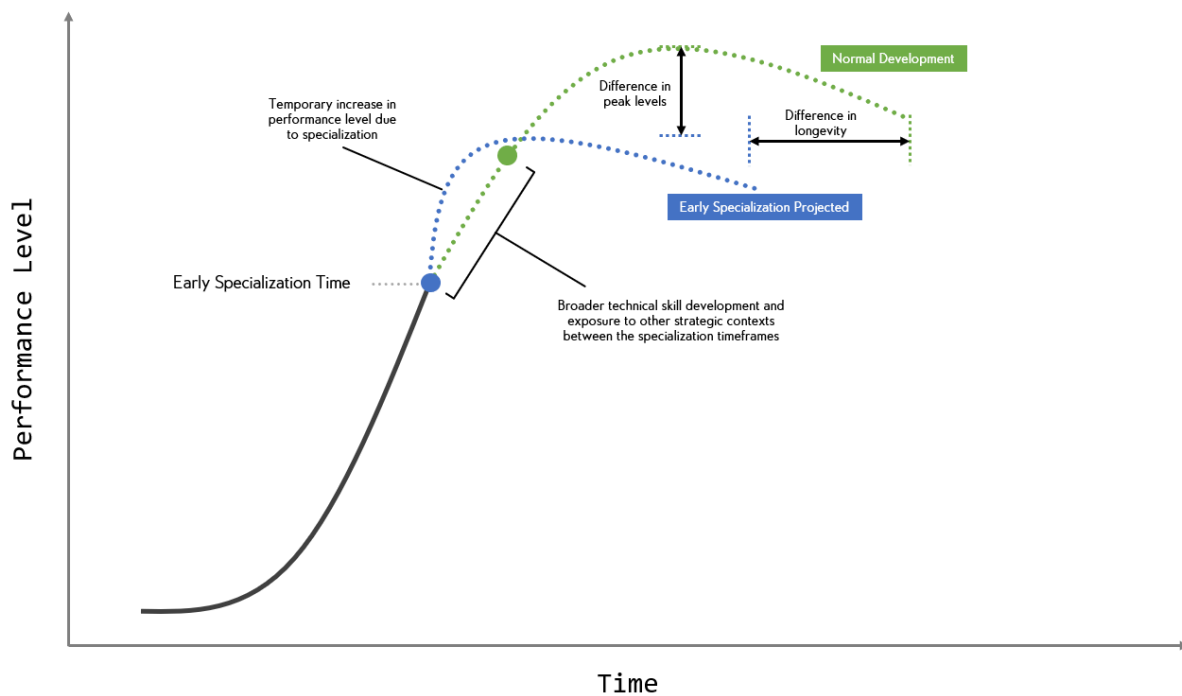


Figure 6 The projected PDCs of a player depending on their time of role specialization

current form at the main role. A situation could not only lower the overall peak performance during a player's competitive career but potentially shorten the overall length.

Players from the ages of 12-16 should be playing and learning multiple roles with complementary technical skillsets and strategic overlap. It will provide broader context for the nuances of the game and each role and these experiences will in not only choosing the best role to specialize in, but also helping the player understand how best to play that role as an interconnected part of a diverse team of players and champions. It will help players respond better to in-game situations and identify win conditions and enable players to learn from their teammates' perspectives and offer critical feedback – both very important at a competitive level. Finally, it would allow the player more options later in their career if they wanted to change roles. The youngest age at which player can enter academy is 16, there is no reason for players to specialize before this time.

Another source of specialization occurs when coaches on amateur and academy teams prioritize results over development. Talented players generally enter these teams with limited knowledge of strategy or depth of technical skills and classes in their role. To win, the team aligns their play styles to utilize their player's strengths and minimize situations that exposes weaknesses. There is a greater emphasis on tactics, where teams adjust their pick/bans and train during the week to beat their specific upcoming opponents. As a result, players opt into playing champions and a style of play that they are comfortable with. Even communication roles are optimized to those who are predisposed to those roles. This comes at the expense of young players developing a broader set of technical skills, classes for their roles, general game strategies and communication standards.

There are multiple reasons why academy and amateur teams are structurally set up this way. First, organizations believe that it will be easier to transition players into the LCS if they follow the same training protocol. Part of this is true – academy players should be exposed to training volume and intensity, get accustomed to the competitive schedule, and learn how to use various resources for their individual training and health. This should however not include the training curriculum. LCS teams need to prioritize results and their training material and process should be separate from an academy or amateur training model that should focus on development of players.

Second, most coaches in e-sports don't have formal training and don't even recognize the distinction between various developmental stages. Their philosophies and theories on coaching come directly from those at the LCS level and so most coaches adapt these methodologies for the academy and amateur players.

Most importantly, there is a pervasive idea in the industry collectively amongst analysts, coaches, fans, organizations, and managers that tournament placement and winning at an academy and amateur level implies a successful program and the young players on such teams with inflated statistics as a result of being on a winning team represent the pinnacle of talent development. For organizations, winning results in their ability to sell players and offset their costs. For coaches, it provides them job security and increases their value in the ecosystem. For players, winning increases their chances of joining the LCS. However, when some of these

players are recruited at the LCS, the tactical advantages that allowed them to succeed at an academy level no longer work against LCS players. These players now have the daunting task of completing their training while competing in the LCS where the priority should be winning, but now under significantly more public scrutiny. This leads to a lot of players remaining on mediocre or bottom-tier teams and are never able to realize their true potential.

If we have any hope of changing the developmental system, it must start by collectively recognizing that the most efficient player development structures may result in a worse performance from those players during competitive matches in the short term. Only then can coaches and players be free to prioritize their development plans in a way that truly prepares them for the more competitive environment in the LCS.

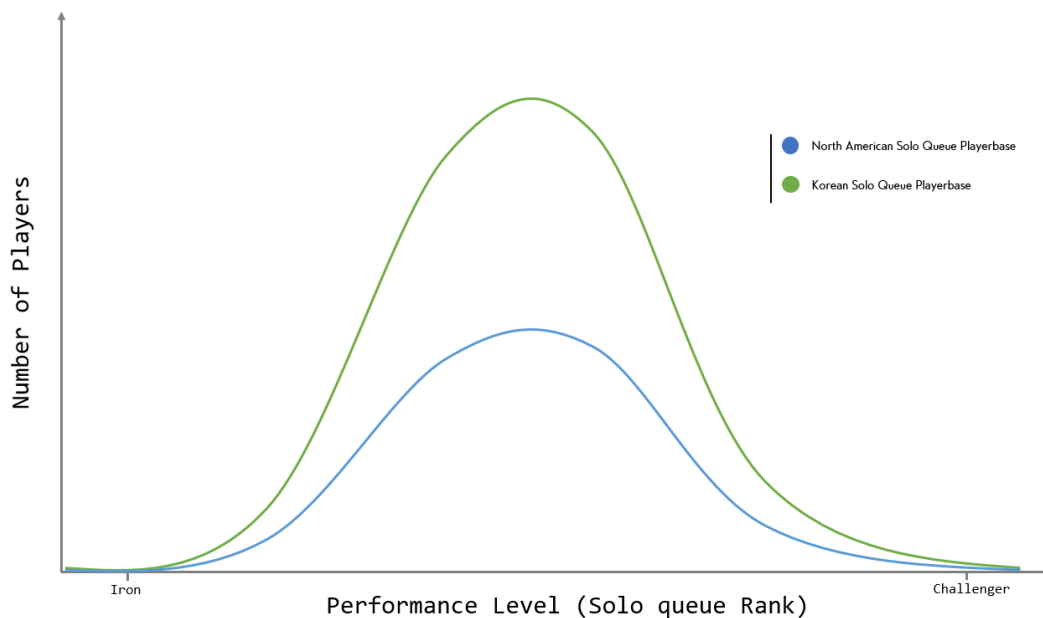


## Importance of Playerbase Size and Competition

While this is slowly changing at the LCS level with the introduction of more positional coaches aimed to help individual players, the vast majority of technical skill development is left up to the players themselves. The critical problem at early stages of a players' journey in League of Legends is that there are few ways to learn the technical skills required individually to be broadly proficient at the game outside of playing a full game against opposing players. Often the final (and sometimes only) step in players learning new champions, mastering skills, optimizing item builds and more is to play ranked solo queue and test themselves against other players at their level. Even professional players who play multiple blocks of scrims per day utilize solo queue as an important tool to refine their skills and learn new ones. As a result the top of the solo queue rankings ladder is populated with a lot of aspiring, active, and retired competitive players who are constantly honing their skills as they play against each other. As iron sharpens iron, it's important for players to be highly ranked in solo queue so they can be matched against stronger opponents who will push players to their limit, helping them internalize better habits and muscle memory, and reaction time. At the same time, players can learn from opponent's deliberate movements, skill usage, and other technical skills and strategy in a variety of familiar contexts that the player creates. The enemy skill level is crucial to a player's own technical skill development, and therein lies a big problem for the LCS.

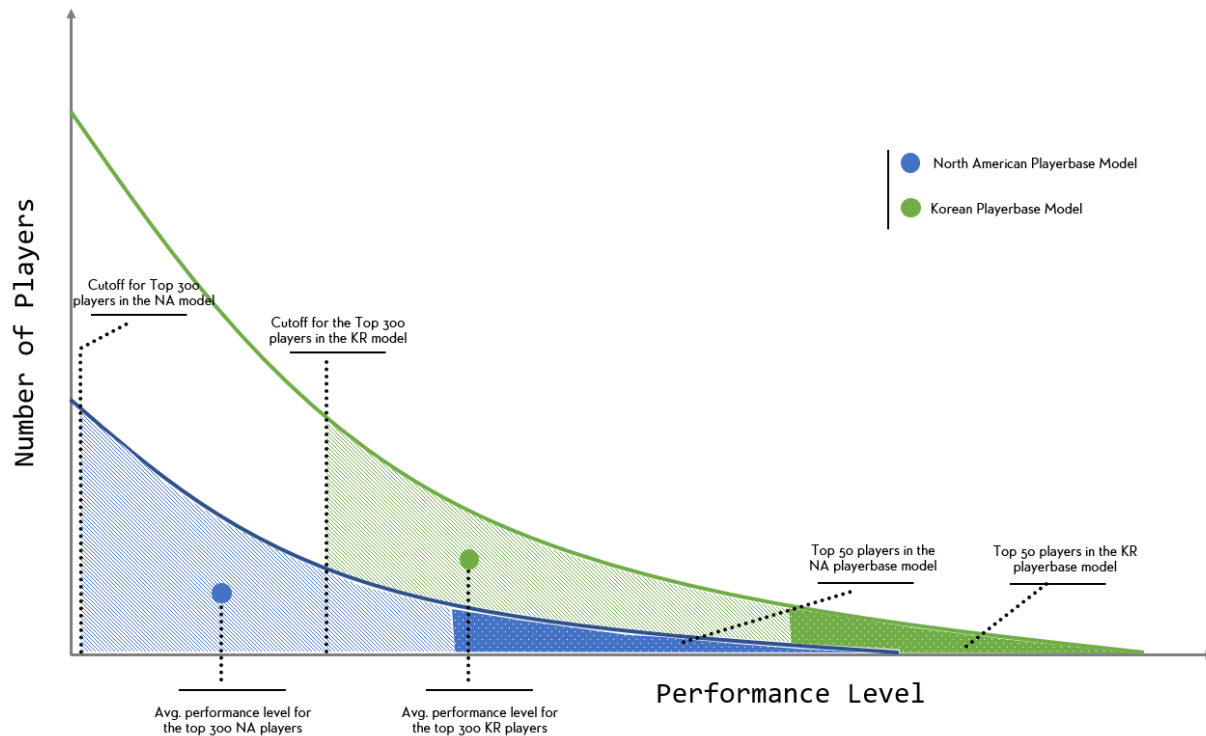
Here are the approximate number of ranked accounts from op.gg at the end of 2021 (for the purposes of this exercise, the absolute numbers matter less, the comparative playerbase ratios are good enough to visualize the argument below):

- North America: 2,113,906
- South Korea: 5,005,034



**Figure 7** The ranked distribution based on the percentage of players by tier applied to the op.gg's estimate of the number of ranked accounts in both the NA and KR servers.

Let's assume a somewhat normal distribution for these accounts and map the number of players that play ranked against the skill level of those players, shown in the first figure. The second figure shows the tail edge that captures the top (for example) fifty players in both the Korean server and the NA server. Based solely on the playerbase size, it's clear to see that a small percentage of top NA players would have a comparative skill level that is competitive with the top players in the KR server. This ratio does not necessarily have to follow the



**Figure 8** The tail end of the curve in Figure 7 with cutoffs for the top 50 and 300 players in each region.

playerbase ratio of the two regions since a lot of different factors affect the edge cases that are many standard deviations removed from the mean.

Next, let's consider that the technical skill development is reliant on the enemy skill level. The way matchmaking works is that at the highest levels of solo queue, Riot can either optimize for the level of opponent or time to find a match. If Riot optimizes for level of opponent, meaning they find players close in skill level only, challenger players will spend more time in queue as they wait for a full lobby of players that are ready to start the game, decreasing the amount of practice you can get in a given timeframe. Conversely, if Riot optimizes for time, they will broaden the number of players that they consider an appropriate skill match, lowering the average skill level of the opponent. The third figure shows the bounds of the skill level if Riot were to consider setting their parameters of matchmaking to 300 players of the closest rank. Again, as a result of playerbase, the top players in NA will be getting considerably worse practice than the players on the top of the KR ladder - which means that while it was statistically possible for a player from a region with a lower player base to have the base skill level to compete against others in a different region, their technical skill development will be

hindered due to lower average skill level of the players they will train against in solo queue. It's possible that professional players may not be negatively affected by this and be able to maintain their skill level, but it's hard to argue that they would be able to improve past the level of the best players on the server.

Finally, the Korean server has a distinct advantage of hosting players from the surrounding Asian countries including China, Taiwan, Vietnam, and Japan etc. The top of the Korean ladder includes professional players from all these various regions, which not only serves to increase the technical skill of the server, but there are also a higher concentration of players that practice with more strategic and tactical depth that comes with their professional experience. This means that aspiring pros that play on the Korean solo queue ladder and reach a rank where they are consistently playing against professional players will not only have an advantage in being able to hone their technical skills, but also be passively infused by strategic patterns of professional play, smoothing their development curve for their path to pro.

North American prospects suffer both from a lack of strong competition at the top of their server to help them hone their skills statistically because of player base size, and due to North America being a relatively isolated region. NA players must compete against players who have had better training environments to train for the same spots on LCS teams. One clear solution is to send NA players abroad to train on the Korean (or at least EUW or CN) server for designated periods of time to develop their technical skills against stronger opponents. This does not imply that every player who reaches challenger in NA must immediately travel abroad to continue their development. It's crucial that players work with coaches who can help evaluate and develop individualized plans for training at an amateur level in order for players to learn how to train. But, after players specialize in their role and join an academy team, they can work with their coaches to attend individual or team bootcamps in the pre-season or between spring and summer seasons.

## Longevity

"Recognizing that one's chosen sport encompasses all aspects of one's life." Career longevity in esports has not been well studied. While certain aspects of digital literacy and specialization timeframe can affect longevity, an athlete's psychology, health, character and the goal of continuous improvement are critical factors.

Players, coaches, organizations, and the entire e-sports industry has a relatively poor understanding of the physiological impact on gaming and competitive e-sports. While various teams may employ physical trainers, sports psychologists, physical therapists etc. to work with their players, they are treated as auxiliary parts of the program and prioritized haphazardly and without clear intent. Ultimately, there are two key reasons why this is the case. First, the brain is not as well understood as the body – so it's hard even for experts to definitively state the impact of various performance metrics on players performance levels over time. Second, the esports industry is young and so teams face a challenge – the overlap between people who are experts in the various fields (sports psychologist, physical trainer) and have a contextual understanding of esports or specific games in which they will be applying their knowledge is very small. Traditional sports have higher budgets and well-established performance programs, making them far more lucrative for experts.

While there are a multitude of factors that affect player longevity, the following section will consider three to demonstrate how game design, training regimen, and competitive schedule – aspects within the control of the publisher and organizations – can impact players on short (day-week) and long (month-year) scales.

## Cognitive Load and the Daily Schedule

For traditional sports, the capacity for physical strain is the limiting factor around which training programs are designed. The physical body has been studied for centuries and LTAD focuses heavily on how to train around physical changes to the body from when a child is born to maturation. The limits of physical strain are well understood, and training programs for athletes balance the amount of time they spend training technical skills with strength training, conditioning and recovery periods to maximize how effectively athletes can train, how much they can push their bodies during competitions, and how long they can continue their careers.

For e-sports, the limiting factor is not physical strain on the bodies. In theory, individuals can play most of their time playing League of Legends as long as they can manage their sleep and diet. However, players have found that the volume of play doesn't necessarily correlate to the level they have improved, instead experiencing diminishing returns or even drops in performance. To explain, we must turn to Cognitive Load Theory which in its simplest form states that working memory (or short-term memory) can only process and retain a limited amount of information at once. In order for learning to happen, information needs to be processed in the short term memory before it can reach the long-term memory. When individuals experience high levels of cognitive loads for a sustained period, they begin to experience cognitive fatigue which results in them being less able to ignore distractions, needing more time to plan, thinking becoming less flexible, and less able to carry out high level information processing. The symptoms of cognitive fatigue include difficulty concentrating, forgetfulness, and irritation. During cognitive fatigue, players may find simple tasks feel difficult, get overwhelmed easily, struggle with sleep, or at extreme levels, experience brain fog or even mental block, when it becomes harder or impossible to think.

When a competitive League of Legends player is playing a scrim, at any given point he is processing a number of things as he considers engaging onto the enemy champion in his lane when he sees an opportunity:

- Visualizing the best form of engage and preparing the follow up
- Things currently on the screen as he is actively engaged against the enemy laner
- Ally players positions on the map and their current strength level and resources (abilities, summoners) to determine who can affect the fight
- Approximate enemy positions, their strength and resources to determine who can help the enemy
- The current team plan and how the engage affects it in the short term and if the risk is worth it if there is any involved
- Long term plan based on the current game state and specific goals set by coaching staff (individual and/or team)
- Information that needs to be provided to the rest of the team
- Various forms of allied communication as they are planning, coordinating, or executing in support of your engage or their own separate play

League of Legends is a game that requires a great deal of thought process. One game of scrimmage involves constant planning, communication, and technical execution where a player is actively or passively considering 5-10 different things at once for 30 minutes (average game time). After this game, all players then watch the game replay with the coaching staff to review the game and provide feedback to each other. At this time, players need to process different perspectives on the game, discuss strategic and tactical options, and offer changes to or create new schema based on the learnings from the game.

Most scrim blocks for LCS teams are 5 consecutive iterations of this game + review structure. After this scrim block, players get a rest for dinner and then have various other obligations from VOD reviews, individual meetings, game preparation, or sometimes a second block of 2-3 more scrim games. Players are also expected to play 5-6 solo individual games in solo queue every day to maintain their form, refine their technical skills and learn new champions.

This daily schedule is rigorous, not only because of the time commitment (approximately 11 hours of training per day) – but also due to the high level of cognitive load that players sustain throughout each day. Each player has a different threshold of cognitive load and its effects on them, but most players start to show some fatigue after the third game in the scrim block. It's generally agreed that the last few games of the block are of lower quality. Coaches often misattribute cognitive fatigue to a lack of effort on the part of the players and even those who accept that it is a result of some sort of fatigue accept the lower quality training as something that cannot be changed. Some players who perform poorly in practice are assigned more individual practice who then proceed to overtrain while mentally exhausted – gaining very little value while simultaneously making their situation worse. This spiral contributes to considerable stress for the players, which if continued through the course of the split can lead to burnout.

For us to address this, let's consider the Cognitive Load Theory in more detail. John Sweller initially proposed CLT to argue that instructional design can be used to reduce cognitive load in learners. This theory differentiated between three types of cognitive load:

1. Intrinsic cognitive load is the complexity of the information or skill associated with the instructional topic. This is the cognitive load that coaches need to simplify or reduce the amount that's introduced at once.
2. Extraneous cognitive load is the load attributed to the design of the instructional materials or how information is presented to the learners. This is the cognitive load that coaches need to identify and minimize because it only serves to distract players.
3. Germane cognitive load is the deep processing of new information that leads to creation or automation of schemas (representation of a plan or theory) – or in simplest terms, when players are able to process information in the short-term memory and it reaches the relevant section in the long-term memory. This is the cognitive load that coaches want to maximize in order for players to learn.

To allow for maximization of the germane cognitive load, coaches must simplify the intrinsic cognitive load and minimize the extraneous cognitive load. For example, if the goal (intrinsic load) is to teach players how to teamfight around dragon, breaking down the task into (1)

vision setup, (2) choose position based on range advantage, (3) consider engage/poke tools before starting or allowing enemy to start dragon etc. and focusing on each sequentially will help reduce the cognitive load and allow players to internalize the steps one at a time. With regards to extraneous cognitive load, while some players will understand concepts from PowerPoint presentations, others may need to see game footage to understand what is being discussed. Some players may need 1-on-1 instruction to allow them to focus on the subject matter rather than focusing on other players, coaches, elements etc. Others might need to reduce their level of responsibility in the game or comms to focus on learning this skill. It's up to the coaches to determine how to best deliver the information or set up situations for the benefit of each player. Unlike traditional sports, where coaches can run drills or assign players to free throw practice where they can learn technical skills in isolation without having to worry about other aspects of the game, League of Legends game design makes it almost impossible to perform drills and learn technical skills without playing the actual game against opponents. Coaches have to be creative how to introduce new topics and isolate learning lessons to reduce distractions from the game in order to allow players to prioritize on them.

In terms of cognitive overload during the day, alternate schedules can be implemented. For example, the Korean league (LCK) prefers a practice schedule of a 3-game block, followed by a 2-3 hour break, followed by another 3-game block. Their facilities have amenities such as rec rooms, massage chairs and bedrooms that allow players to step away from the game, eat, relax, and even take naps during their break. Unlike the LCS regimen that forces players to play five games in a row, where the last few games become inefficient due to cognitive fatigue allowing for only 3-4 efficient games of practice, the LCK system's shorter blocks keep the players from getting too tired and the long recovery period allows for players to return refreshed, yielding 6 games of efficient practice per day.

Cognitive load and its short term and long term effects on e-sports athletes have not been properly researched, documented, or studied. It's only through proper application of cognitive load theory onto training design can players develop more efficiently at all levels of their development.

## Periodization and the Ever-Changing Game

The LTAD model when considering the Train to Compete and Train to Win phases assumes that the rules of the sport don't change significantly. It proposes that players have to spend less time training because in physical sports, mastery of technical skill and strategy only need to be maintained and refined. This allows experienced competitors to focus on tactics, health, and other aspects of their life, as long as they follow a proper periodization of their training schedule. At its core, periodization allows athletes to plan their year, month, week in order to optimize performance during competition, prevent overtraining, and track performance. Athletes are able to plan the intensity and volume of training throughout the year to hit their performance peaks during important competitive events.

League of Legends, however is a game that constantly changes in order to keep an active player base engaged. For e-sports players however, this means that the game will change dramatically before the start of the season and sometimes even between the season, and there will be meaningful changes to champions, items, and strategic elements in the game once every two weeks, throughout the year. It's harder to set periodization goals for athletes because they have to be ready to adapt to any changes. Consider the ADC role which used to primarily be composed of ranged auto-attack based champions. A few matches changed the role such that mages were now the optimal champions for the role. Mages have different item builds and playstyle compared to marksmen. Not only that, mages in the bot lane receive a different level of experience and gold compared to those played in other lanes, and so the impact has to be studied and mastered by players. These changes aren't trivial and force players to relearn or master for the first time strategic aspects of the game and technical skills. With the exception of the large changes at the beginning of the season, these patches are often reactionary to the evolving meta-game and even the publisher often does not understand the full impact of these changes when they are deliberate. As a result, players often don't know what the changes to the game are going to be, what impact they are going to have, if they were deliberate and will sustain or will be removed within the upcoming patch cycles. Players are forced to adapt to changes every two weeks, and therefore don't have the luxury of setting up any long term periodization for training – their volume and intensity of training has to be generally in reaction to these changes.

Most solutions to this issue have to come from the publisher. Riot generally has an idea of large scale changes that are going to be implemented in the game and the approximate patch cycle in which they will occur. Communicating these to professional teams ahead of time would potentially allow players to better plan their training cycles. For unintended large or disruptive changes, Riot can temporarily de-sync the competitive patch from the live patch to allow teams and players practice time over multiple weeks to learn the impact of these changes and new optimal states rather than players having to drastically adjust their training volume to compensate. Overall, the more information players and teams can receive regarding the size, timing, and intent of changes to the game will help some level of healthy periodization to be structured into the training regimen.



## Competitive Schedule and Burnout

For the 30% of LCS players that attend the World Championships, their competitive and training schedule looks approximately as follows:

- January 1 – January 14: Pre-season bootcamp (All teams)
- January 15 – January 31: Lock-In Tournament
- February 5 – March 14: Spring Regular Season (Top 6 Teams)
- March 20 – April 11: Spring Playoffs
- May 6 – May 23: Mid-Season Invitational (Spring Playoff Winner)
- May 1 – May 21: Bootcamps/Tryouts (~30% of players)
- June 4 – August 1: Summer Regular Season
- August 7 – August 29: Summer Playoffs (Top 8 Teams)
- October 5 – November 6: World Championships (Top 3 Teams)
- November 6 – November 30: Tryouts and Contract Negotiations
- December 1 – December 30: Individual bootcamp and/or break

Most top players, who represent the 3 teams attending the World Championships have a stringent competitive and training schedule. Even the teams that don't qualify for Mid-Season Invitational (MSI) will often bootcamp in Korea with their entire team or individually to improve before heading into the Summer Split. Most teams who attend MSI have expressed concerns regarding player burnout and anecdotally MSI-attending teams show a drastically worse performance at the start of Summer Split. Subs are rarely utilized in the LCS as a way to allow the starters to recover which leads to a long season of competition for the top 30% of players. Players who choose to take a split off or attempt some level of periodization where their intensity of practice is lower during parts of the year are stigmatized. This coupled with the inability to set up long-term periodization leads to a scenario where most players are being pushed by their coaches to train at a level could induce early burnout, and force players to compensate, into unhealthy relationships and poor life choices that affect their mental well-being and make their careers unsustainable. It's crucial for organizations, coaching staff, performance staff including mental health experts to work with players on their roster on their long term vision, not only in terms of their career, but also their pursuit of interests and relationships outside. It is only by creating a plan to balance the two and iterating on it as time goes on, can players truly extend their careers in a healthy way.

## Generational Confluence

In the previous section, we considered multiple factors that affected player career longevity. Now, let's discuss the manner and circumstances under which players retire. In traditional sports, limitations in the physical bodies of the players as they age decreases their motivation, ability to train, and overall performance. However, in alignment with Yip's theory of aging and its impact on esports athletes, we believe that aging does not significantly lead to declines in fine motor skills or cognitive performance – at least at the ages of players that are retiring today. Despite this, it is becoming clear that younger players are slowly performing better than newer players and on average seem to demonstrate higher levels of peak performance.

To explore why, let's consider that a player who is 27 today was born in 1995. They grew up during a time where internet slowly transitioned from dial-up to broadband, cell phones went through the mobile data revolution going from mobile telephones to smart phones, computers became more accessible as laptops and tablets, and the new generation of consoles started refining their multiplayer capabilities. Players who were born in 1995 had a significantly different digital gaming experiences than those entering the competitive scene now who were born in 2005. Those ten years marks a significant difference in the digital literacy during their formative years. We expect that this allows players to have a higher aptitude for gaming in general and allows players to learn and master technical skills at a faster rate. Younger players now, specifically playing League of Legends are joining a system with ten years of infrastructure and a catalogue of documented technical skills and strategies that they can learn from compared to the generation before them that had to develop themselves. As a result, it is

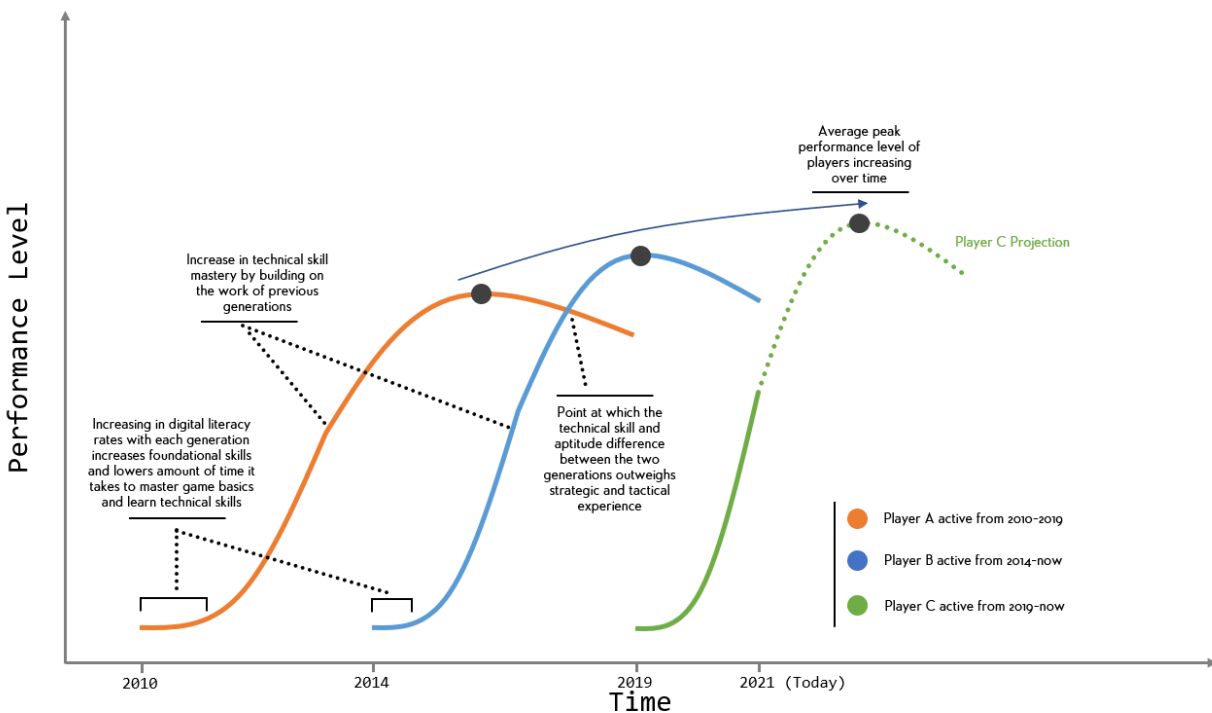


Figure 9 Average PDCs of players across different generations

likely that on average younger players have a higher baseline skill level and can develop peaks that surpass the previous generation.

Consider the figure above, teams who are able to compare the development ages of players can make informed decisions in which players to recruit and when. For example, in 2018, Player B and Player A have the same performance level. It is at the point where the technical skill and aptitude difference between the two players outweighs the strategic and tactical experience of Player A. In comparing these two players, there is relatively little risk for teams to opt for Player B since it is likely that he hasn't reached his peak yet. Next, let's consider the current off season (2021), where Player C is at a much earlier developmental stage and performance level than Player B, but also commands significantly less salary as a result. Teams who opt for Player C recognize the skill difference, but are hoping that their coaching staff can develop the player along the projection shown in the diagram. In both of these cases, it is not the player's performance levels or deterioration that is causing organizations to lose interest in them, but rather the advantages the newer generation of players have that is allowing organizations to take educated guesses or risks on their performance level being higher under proper coaching.

One further note that needs to be addressed is that the rate at which digital literacy is increasing is slowing down, and the relevant technical skills and strategies that exist in the game have mostly been discovered and new champions or additions to the game are happening at a far slower rate. Future generations will not have the same level of advantage over the current generation that this generation had over the previous. This would imply that career longevity will continue to increase as time goes on.

## RECOMMENDATIONS

The following recommendations build upon the topics that were introduced in the literature review and the following discussion. We have categorized the majority of feedback into short-term recommendations that include differentiated coaching and technical skill development and specialization and long-term recommendations that influence digital literacy and structural pathways for players.

### Differentiated coaching

Players exposure to gaming varies dramatically depending on the context in which they learned the game and the skills. Remedial coaching needs to happen at all levels to ensure that players have a standardized understanding of the fundamentals of not League of Legends, but gaming itself. Every coach should have the ability to evaluate players on foundational skills that may include anything from posture, key bindings, mouse DPI to their specific level mastery of the game so far. Often times, new players have large gaps in knowledge, skills, or etiquette that needs to be addressed before they are able to proficiently move forward in their development. For example, a player that doesn't use the appropriate key bindings or plays on locked screen mode is making the game unintentionally harder and developing bad or inefficient habits to compensate.

The weight of the responsibility of remedial coaching lies first on amateur coaches who see the highest percentage of players that have no prior coaching experience. Amateur coaches as a result should be trained on how to do a full analysis of players and catch them up on any missing foundational knowledge. After that, they should focus on a wide variety of technical skill development and introduce general strategies and communication standards to players. At this time, they should encourage players to diversify their practice to include multiple roles and classes. Any focus on tactics at this point should be considered relatively pointless or done as an exercise to show what it may entail. The goal at this level for coaches should be to teach players what to learn or train.

At the academy level, players move into professional team facilities and work in person. Coaches should help players first transition to the new environment by adjust the volume and intensity of training and exposing players to the schedules that they need to adhere to at the LCS level. Academy coaches should at this point be working with players to refine the full set of technical skills after specialization, as well as expand on a wide variety of strategies and communication responsibilities. This is also the best time to introduce some basic tactics, but they still shouldn't take precedence over players exploring the full breadth of necessary skills for their role or all the elements that players need to learn to drill, coordinate and execute strategies with their teammates. The goal at this level for coaches should be to teach players how to learn or train.

Organizations need to recognize that development programs require quality coaches and scouts who also require their own training regimen. Each coaching staff requires game knowledge, an understanding of systems and how to teach, leadership qualities, and some

knowledge of mental and physical health. The prime candidates for new coaches come from either side of the competitive phase in the PDC – the players that are barely not good enough to pursue the game professionally and professional players who are retiring. As these players explore opportunities in e-sports outside of playing, organizations can find many pathways to give them the requisite experience to develop into strong coaches or leaders in the staff. This can be done by offering scholarships, work-study programs, internships for coaches, analysts, sports psychologists etc. that want to specialize in e-sports based on their interest.

## Technical Skill Development and Specialization

Players should not play League of Legends as their first or only game early on. As a game, League of Legends places too much cognitive load on players while playing entire games that theoretically it should make it harder for players to learn isolated foundational gaming skills such as aim, timing, movement etc. efficiently. Competence in these skills learned in other games or simpler contexts will make it easier to develop the specific technical skills required later.

Players should diversify their technical skillset as much as possible – which means learning as many different champions and classes as possible. While it may take longer to climb the ranked ladder, the foundation will be more important as these experiences will contribute to a stronger performance after specialization. This does not imply that players should always fill during ranked. Players can opt to temporarily specialize to gain a high rank, and then add accounts for different roles while maintaining the skills for their first or primary role.

In the short term, Riot could add quests and other bonuses for players to play a certain amount of games or achieve a certain mastery in various roles or number of different champions – especially when players first start playing PvP modes or ranked in order to show that diversification is valued.

At the amateur or academy level, players should prioritize expanding and refining their technical skillset, rather than leveraging the existing skillset to perform well in competitions – in simplest terms, players should learn new champions, classes, and styles of play that isn't their strong suit to become a more well-rounded player rather than only playing the champions or style that suits them at that point to win. Players should also focus on increasing their strategic depth and communication responsibilities and lowering the priority on tactics. Tactics used at an academy level will not be as effective at the LCS level and beyond, while the other three facets are more important for players to master before promotion.

Riot could, in the long-term, create specialized modes within the game to help train basic and technical skills. For example, a mode drawing from elements of tower defense games where a player controls a champion and the objective is to last hit minions. Each level increases the difficulty by altering amount and type of minions that spawn for each team, adding opposing champions who harass, while player can add abilities and buy items. While this is theoretically possible in the practice tool, a purposeful mode that challenges and rewards players for

playing can help incentivize younger players a way to train isolated skills independently of the game, helping achieve mastery at a faster rate.

Organizations should set up temporary training infrastructure in Korea (or China/Europe) and send players on bootcamps or extended stays before the season start or between seasons to allow them to play solo queue on their servers after player role specialization. This will allow players to learn and refine technical skills against stronger players.

## Digital literacy and Structural Pathways

In the long term, increasing digital literacy rates at a young age will both increase the number of players that play League of Legends, but also increase the quality of players as it will increase their aptitude for gaming in general. For that to happen, it's the responsibility of parents, schools, and community programs to expose children to a variety of digital devices and gaming contexts. Riot has the most influence over this. The show "Arcane" is an excellent example of the level of impact that Riot has as its level of mainstream appeal will undoubtedly bring many fans of the show to explore games under the Riot umbrella. Even the creation of games such as Legends of Runeterra and Teamfight Tactics that introduce the Riot universe to casual players will draw a small number of those players to League of Legends.

Specifically in the United States, the majority of middle and high school students have the opportunity to participate in after-school athletic programs and scholastic clubs based on their interests and are led by teachers, parents and other leaders in the community as mentors and coaches. There needs to be an effort to work with representatives at the state and local level to recognize e-sports and gaming so that middle and high schools have the ability to organize and fund clubs and after school programs. The mentorship from these programs – especially if guided by the principles of LTAD – would help bolster the number of players interested in pursuing higher levels of competition in play and the overall playerbase of the region.

Riot's rules for community competitions needs to be re-evaluated to allow high schools, colleges, and local organizers to operate independent leagues and provide parallel pathways for players of all ages and skill levels outside of professional sports to engage with League of Legends. Under the current North America Community Competition Guidelines, Riot places many restrictions on these programs, notably:

1. Total sponsor contributions for each tournament your organization runs are limited to \$10,000 in value. In addition, your organization cannot receive more than \$100,000 in sponsorships in a Calendar Year for League of Legends tournaments.
2. Competitions must start and finish within 14 days.
3. No more than 16 schools may participate in a given Competition.
4. Competition name cannot include the words: Varsity, Season, Championship, Post-Season, League, or Playoffs.

The limit to sponsor contributions hurt collegiate and local institutions from creating sustainable leagues or tournament circuits. The other restrictions limit various competition formats that are standard for middle and high schools at the regional and state levels.

## Fitness and Mental Health

Organizations must start investing into cohesive performance programs that include sports psychologists and therapists, fitness trainers, dieticians, and chefs etc. working under the same centralized leadership as coaching staff. Sports psychologists can help coaches assess players' emotional and leadership capabilities when recruiting. A player undergoing a period of stress can exhibit physical as well as emotional symptoms, either if caught and addressed appropriately can benefit their performance in the short term, but an aggregate of these initiatives can help players maintain their level and increase their career in the long term. Fitness experts can work with dieticians and chefs to create individual plans or work with coaches by incorporating sleep tracking, adjusting workouts etc. for each player to maximize their focus during different schedules and in support of their long-term goals. It is only by slowly and deliberately adding, assessing, and iterating on these projects can organizations start to contextualize these resources and maximize their utility.

The short-term impact of these initiatives will vary, but organizations that can first sync these elements into their assessment and training of players will have a distinct advantage in the long run working with players and staff better deal with cognitive load, setting up periodization during the year, and helping players see through their long-term training regimen and goals, thereby extending their careers.

## SUMMARY

League of Legends is a game developed by Riot Games that averages 100 million monthly players and has a competitive ecosystem that includes 12 domestic leagues, one of which is the LCS, representing the North America. LCS teams have been heavily criticized by the global community for consistently failing to perform at international tournaments while importing talent from the other major regional leagues instead of developing regional talent. Compared to traditional sports, League of Legends is still at its infancy as an esports and there currently exists no framework with which to discuss talent development in a nuanced manner. A Player Development Curve (PDC) that maps an average League of Legends professional player's performance level from when they first started playing the game through the course of their career is one such framework and allows us to break down the different segments of player development to examine the factors that affect each stage.

The Long-Term Athlete Development (LTAD) model from traditional sports allows us to expand on the PDC and define key developmental stages. The first few stages refer to children as they start familiarizing themselves with digital environments and devices that control them, basic gaming skills, and learning rules from a variety of gaming genres. The next two stages chronicle a player's independent journey through ranked modes where they learn a variety of technical skills after which they have the opportunity to join amateur and academy teams where they learn communication, strategy and team competition. The following stages capture a player's professional journey as they join the LCS, optimize training, focus on tactics, and perform at highest levels of competition. Finally, the last stage looks at the various pathways for players after they retire.

Utilizing the stages defined by the LTAD model, we can start looking at various factors that impact player development and how players can be better assessed and trained by coaching staff. One important factor in assessment is the concept of development age which provides coaches and scouts an alternative way to categorize players instead of chronological age by considering a player's journey prior to the time of assessment.

Next, when considering a player's peak potential, digital literacy of children at a young age may impact their aptitude for gaming, and subsequently the rate at which they pick up technical skills. The time of specialization is crucial because a player who spends their early developmental years learning a wide variety of technical skills and first-hand knowledge of other roles will be able to demonstrate stronger performance later in his career compared to a player who specializes early and has limited understanding of how other roles and game states are interconnected. A player's mastery of technical skill is also correlated to the performance level of the practice opponent. Regions such as Korea who have higher playerbase numbers have an inherent advantage due to higher average skill level of players at the top of their competitive ladder.

With regards to player's career longevity, cognitive load theory demonstrates that the limiting factor for players to focus and learn is reliant on the type and amount of cognitive load they experience in practice. In the long term, the competitive schedule that spans from early



January through November coupled with the game constantly changing allows players few opportunities to set up training regimen for the long term, leading to increased chances of burnout. The idea of generational confluence shows that as digital literacy rates increase and as more and more technical skills have been discovered, the newer generations on average have an advantage in their development leading to average peak performances increasing over time. This leads to organizations comparing player potential at various levels of a PDC to those of veteran players demonstrating that many players are retiring not due to any fall off in their skill level, but due to the relative and projected skill level of players entering the competitive space.

In the short term, two key factors need to be addressed to produce better, more-well rounded players. First, coaching at the academy and amateur levels should not copy the LCS model which is based on winning, they should instead progressively and somewhat sequentially focus on foundational gaming skills, variety of technical skills, and then strategy. Tactics should only be introduced if the other aspects take precedence. Organizations should target amateur and retired players and help them transition to coaching and other leadership positions through internships, work-study programs, and scholarships. Second, players should diversify their gaming experiences and focus on technical skill development. At an early age, children should be encouraged to play other games as League of Legends game structure does not allow players to isolate and efficiently learn foundational skills. Next, players should diversify the number of classes and roles they play to gain more technical skills and gain a contextual understanding of how those roles and classes operate so that when players specialize, they have a more holistic view of the game. In the short term, Riot can add quests and bonuses as incentives for players to play a certain volume of games or achieve a certain mastery in other roles. After players join a semi-professional team, organizations should set up bi-annual bootcamps to Korea or other countries with a higher player base to allow players to refine their technical skills against stronger players.

In the long term, Riot and organizations should work together to increase digital literacy and provide younger players more motivation and pathways to go pro. One way is to work with representatives at the state and local level to unlock esports for middle and high schools as after school or club programs. Riot also needs to loosen their restrictions on Tier 3 tournaments rules to allow more collegiate and local organizers to create events to engage players of all ages. Organizations should also start investing into cohesive performance programs under a centralized leadership that includes coaching staff in order to provide better study the impact of various initiatives on player development and career longevity.

## AUTHOR'S NOTE

I have worked at TSM's League of Legends division for seven years, one year as an analyst, two years as a head coach, and four years as the general manager. My intent behind writing this is not to serve as a manual, but rather to demonstrate how complicated this topic is and how different elements could be connected. It is likely that I am wrong about some of the topics I've presented, and I haven't explored others to the full extent that they deserve. However, I hope it leads to a more nuanced conversation about esports player development because every time I see this topic discussed in a public forum or even amongst my peers, it is too focused on specific elements or problems to find someone or something to blame, rather than seeing the bigger picture.

On a specific note, North America faces an immense challenge in competing with other major regions due to the size of their League of Legends playerbase coupled with their isolation as a region. While importing players is a reasonable short-term option, there are critical problems. The best players (established and amateur) in other major regions will not want to come to NA without getting paid a substantial premium because they are losing their prime opportunity alongside stronger players for a chance to perform well at World Championships. Therefore, the level of import players willing to come to North America will not be as competitive as the top players in their respective regions. While it will increase the level in North America, by itself – importing will not solve our problems internationally. Talent development is the primary alternative that is left to us and there are many things in our current approach that we can change to maximize the quality of players we produce and better utilize the players we do decide to import.

In general, while this paper specifically explores esports player development within the context of League of Legends in North America, the LTAD model can be applied to a variety of different esports if the Player Development Curve for the game is appropriately defined. This is important because many esports organizations today have teams in multiple esports, each of which are treated as isolated ecosystems with their own set of rules, coaching staffs, performance programs. The first organization that can standardize talent development under a centralized leadership with an overarching performance program and coaching development structure will have an immense advantage in the next decade.

Please reach out to me via twitter or email in the contact page if you would like to discuss any of the topics I've mentioned in more detail privately or in a public forum.

## BIBLIOGRAPHY

- Bompa, Tudor O. *Periodization Training: Theory and Methodology-4th: Theory and Methodology-4th*. Human Kinetics, 1999.
- Côté, Jean, et al. "ISSP Position Stand: To Sample or to Specialize? Seven Postulates about Youth Sport Activities That Lead to Continued Participation and Elite Performance." *International Journal of Sport and Exercise Psychology*, vol. 7, no. 1, Jan. 2009, pp. 7-17. DOI.org (Crossref), <https://doi.org/10.1080/1612197X.2009.9671889>.
- Craik, Fergus I. M., and Ellen Bialystok. "Cognition through the Lifespan: Mechanisms of Change." *Trends in Cognitive Sciences*, vol. 10, no. 3, Mar. 2006, pp. 131-38. DOI.org (Crossref), <https://doi.org/10.1016/j.tics.2006.01.007>.
- Kirk, David. "Physical Education, Youth Sport and Lifelong Participation: The Importance of Early Learning Experiences." *European Physical Education Review*, vol. 11, no. 3, Oct. 2005, pp. 239-55. DOI.org (Crossref), <https://doi.org/10.1177/1356336X05056649>.
- Le Masurier, Guy, and Charles B. Corbin. "Top 10 Reasons for Quality Physical Education." *Journal of Physical Education, Recreation & Dance*, vol. 77, no. 6, Aug. 2006, pp. 44-53. DOI.org (Crossref), <https://doi.org/10.1080/07303084.2006.10597894>.
- "League of Legends Rank Distribution in Solo Queue - November 2021." *Esports Tales*, <https://www.esportstales.com/league-of-legends/rank-distribution-percentage-of-players-by-tier>. Accessed 3 Jan. 2022.
- LoL Esports. <https://lolesports.com/article/lcs-2022-format-update/bltec9364825do5of86>. Accessed 3 Jan. 2022.
- Mizuno, Kei, et al. "Mental Fatigue Caused by Prolonged Cognitive Load Associated with Sympathetic Hyperactivity." *Behavioral and Brain Functions*, vol. 7, no. 1, 2011, p. 17. DOI.org (Crossref), <https://doi.org/10.1186/1744-9081-7-17>.
- Paas, Fred G. W. C. "Training Strategies for Attaining Transfer of Problem-Solving Skill in Statistics: A Cognitive-Load Approach." *Journal of Educational Psychology*, vol. 84, no. 4, Dec. 1992, pp. 429-34. DOI.org (Crossref), <https://doi.org/10.1037/0022-0663.84.4.429>.
- "Riot Developer Portal." *Riot Developer Portal*, <https://developer.riotgames.com/policies/na-tournaments>.
- Ryan, Kevin J. "How This Company Is Turning High School E-Sports Into a National Phenomenon." *Inc.Com*, 30 Apr. 2021, <https://www.inc.com/kevin-j-ryan/playvs-high-school-college-esports-growth-update.html>.
- Stanton, Rich. "With 180 Million Players, League of Legends Games Have More Active Users than Steam." *PC Gamer*, 2 Nov. 2021. [www.pcgamer.com, https://www.pcgamer.com/with-180-million-players-league-of-legends-games-have-more-active-users-than-steam/](https://www.pcgamer.com/with-180-million-players-league-of-legends-games-have-more-active-users-than-steam/).

Sweller, John. "Cognitive Load During Problem Solving: Effects on Learning." *Cognitive Science*, vol. 12, no. 2, 1988, pp. 257–85. *Wiley Online Library*, [https://doi.org/10.1207/s15516709cog1202\\_4](https://doi.org/10.1207/s15516709cog1202_4).

Way, Richard, et al. *Long-Term Athlete Development*. United States, Human Kinetics, 2013.

Webb, Kevin. "More than 100 Million People Watched the 'League of Legends' World Championship, Cementing Its Place as the Most Popular Esport." *Business Insider*, <https://www.businessinsider.com/league-of-legends-world-championship-100-million-viewers-2019-12>. Accessed 3 Jan. 2022.

Yip, Robert (BA, MA). "Esports Performance and Aging." *Medium*, 21 Apr. 2021, <https://coachyip.medium.com/esports-performance-and-aging-e01149276f8e>.