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Title: Foundations for Esports Curricula in Higher Education

Foundations for Esports Curricula in Higher Education

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ABSTRACT

Esports has generated an industry of increasing economic and cultural importance. In recent years, universities and other higher education institutions have responded to its growth by establishing programmes of study which aim to satisfy the needs of innovators operating in the area. However, there is not yet consensus on what an esports curriculum should include. Despite being a technology-driven sector with ethical and professional dimensions that intersect computing, current ACM and IEEE curricula do not mention esports. Furthermore, existing courses tend to provide teaching and training on a wide variety of topics aside from those traditionally in computer science. These include: live events management; psychological research; sports science; marketing; public relations; video (livestream) production; and community management; in addition to coaching and communication. This working group examined the requirements for developing esports studies at universities with a focus on understanding career prospects in esports and on the challenges presented by its interdisciplinary complexity. Thereby, paving the way for a framework to support the design of esports curricula in higher education.

*(co-leaders)

CCS CONCEPTS

• **Social and professional topics** → **Computing education programs**; *Computing industry*; *Model curricula.*

KEYWORDS

esports; curriculum; course design; higher education

1 INTRODUCTION

In recent years, many higher education institutions have considered the inclusion of esports into their educational provision. After all, the esports sector has become increasingly important from both a cultural and an economic perspective, offering many opportunities to those with the relevant knowledge, attitudes, and skills. However, designing a curriculum which can successfully aid graduates to secure a career in the esports sector represents a challenge. This is because esports remains an emerging field that is being shaped by numerous disciplines that offer many different career trajectories. Furthermore, innovation continues in this space, creating new and unforeseen opportunities whilst driving the evolution of existing roles. There is not yet established practice on how educators and curriculum designers should incorporate the study of esports into higher education programmes, nor is there yet a robust skills-based framework to support the effective design of esports curricula.

There have already been a few trailblazing initiatives to develop the study of esports in higher education. Jenny, Gawrysiak and Besombes [63] identify many such initiatives, spanning North America, Europe, and Asia. However, they observed that the majority of these courses focused on esports business (e.g., management, marketing, event planning, economics, business administration, etc.) with only a minority in areas such as media production, broadcasting, coaching, or technology. It is therefore questionable whether current emphasis, seen in various curricula, aligns with industry needs. Other efforts have also not been without criticism. For example, one industry certification was widely condemned as irrelevant on social media [44]. Furthermore, there are concerns that the traditional organisation of departments at many universities is inadequate for esports instruction [77]. This is because esports crosses disciplinary boundaries (e.g. computer science and leisure [148]) in ways that problematise traditional degree pathways.

As such, esports education is a contentious space which should be approached with diligence and due care. However, there is a concerning lack of discourse in the computing education literature on the study of esports and the development of educational programmes that include esports. The term 'esports' does not appear at all in the CC2020 curriculum [2]. This is surprising because computer science educators will likely have a key role to play in the design and delivery of esports curricula at many institutions. There is already promising work on transferable skills such as those discussed by Lee and Steinkuehler [82]. Moreover, Anderson *et al.* argue that esports "connects to STEM entrepreneurship, and [forms] a community that natively fosters acquisition and mastery of knowledge and skills that connect to high tech sector jobs" [5]. It is therefore important for computing educators to contribute to the broader development of esports education. To remedy this absence of discourse and to encourage computing professionals to contribute to the development of esports curricula, a working group convened at the 2021 ITiCSE conference to explore the question: *what should a higher education esports curriculum include*?

2 APPROACH

This report synthesises discussions between members of the working group. In doing so, it gives some context for esports, provides an overview of esports careers, yields insight into present industry demands, and outlines the current state of esports education. Moreover, the group offers recommendations, some of which could form timely considerations for CS202X, which the group anticipate will lay the foundations for a future framework to support the design of esports curricula.

The working group was formed in 2021 and convened in March, ahead of the ITiCSE conference in July, and adjourned in September. The objectives of the group were, firstly, to establish an understanding of the esports ecosystem and to present this to educators who were unfamiliar with the field, and secondly, to stimulate discourse on the design of esports curricula. With respect to this latter point, it was deemed important to determine what the opportunities for graduates in the esports sector are and to what extent existing educational provision supports graduates

in seeking those opportunities. So, as a starting point, these questions were investigated by members of the group ahead of discussion regarding curriculum. Principally, work was structured into four packages, some overlapping and some conducted concurrently by different members of the group: (i) orientation; (ii) contextualisation; (iii) survey; and (iv) offering recommendations.

The first stage of the project involved initial discussions to orient the research as well as to clarify scope and objectives. Key definitions and terms were debated and important aspects of esports content were discussed. It was acknowledged that a fully-formed curriculum is beyond the scope of this initial project, but that this working group report would lay the foundations for a curriculum framework, paving the way for the development of esports studies.

The second stage of the work established the background and context, so that an understanding of the esports sector could be shared with potential readers. This consisted of a combination of literature review and discussion between members of the group. This work, primarily reported in Sections 3 and 4, provides an overview of the sector and draws attention to some of the challenges it faces which educators and graduates should be aware of. Particular attention was drawn to critical methods in an effort to highlight challenges and controversies that may be pertinent to explore in a formal educational setting.

The third stage of the project involved a survey of the careers trajectories currently available in the esports industry, and a survey of existing provisions for esports education. These findings are reported in Sections 5 and 6. The data on career opportunities was sourced using a web scraper to record a snapshot of jobs advertised on three prominent recruitment websites that purport to serve the esports sector: rektjobs, hitmarker, and psing. Although not the only job search engines targeting the esports industry, these were selected as they are long-standing and commonly used by prospective applicants, albeit primarily in the English-speaking sectors of the industry (although psing covers Singapore). The data on degree courses was obtained from a previous study [63] and extended with recently announced courses that working group members were aware of. Once the data had been collected, both surveys followed similar approaches to analysis, relying upon a method of content analysis that resembles Braun and Clarke's thematic approach [18]. A schema was formed, firstly taking an inductive approach to data familiarisation and coding, and then reconciled with other sources to provide some level of face validity for the schema. Notably, referencing earlier studies and prior research conducted by members of the working group (i.e., [5, 14]). Additionally, small-scale consultations with people who were working in esports and in esports education. Two raters then deductively rated the jobs and courses according to the schema. The group then agreed on final classifications, from which counts and other descriptive statistics were computed.

The fourth stage of the project represented the formation of the curricula framework. It involved a gap analysis based on the findings from the third stage and further synthesis of the career and learning opportunities into key competencies related to the different fields associated with esports. These informed the curriculum design activities reported in Section 7 and the recommendations summarised in Section 8.

3 BACKGROUND

It is anticipated that the audience for this report will include some people in industry, perhaps because they have an interest in the educational landscape or because they wish to inform their hiring practices. However, the audience is also likely to include pre-service and in-service teachers, curriculum developers, university administrators, and academics with an interest in the development of esports studies. Notably, people in university departments which are considering whether to create courses in the area of esports, some of whom might be unfamiliar with the esports field. As such, the following section presents a broad background on esports for the unfamiliar reader.

3.1 What Is Esports?

There is considerable debate on what esports is and what constitutes an esport (see e.g., [47, 52, 91, 121, 132]) and on the varying terminology used to describe them (from [64]: electronic sports; cybersports; professional gaming; competitive computer gaming; and virtual sports). Many authors argue esports is a form of sports [53, 64, 68, 108, 138, 145, 147], or will be considered sports in the future [51], or are experiencing 'sportification' [55], though these positions are contested [105, 118]. Even the acceptable spelling of the term has proven a controversial topic[1] [26]. As such, there is not yet a widely accepted definition of esports. Some authors place emphasis on digital games that have an established culture of competitive play and spectatorship [3]. Other authors place emphasis on the act of livestreaming competitive play [66]: the production and broadcasting of content live over the Internet. Some even argue esports are sports which are primarily facilitated by electronic systems [52].

Some theorists such as Karhulahti [69] emphasise the inherently capitalist nature of esports due to the economic ownership of a given video game by a large developer or publisher. However, this privileges only the most popular esports and may fail to capture cases where the community is resistant to corporate ownership or plays the game competitively through legally questionable means. This could include emulators or mods that aim to replicate a game genre or specific game in their entirety, regardless of the consent of the corporate author of the game. Using certain metrics (e.g. financial success), esports as a label could be co-opted by large corporate game publishers and resisted by grassroots communities. What generally characterises esports seems to rest less upon the particular attributes of games, players or acts of play and more upon the surrounding culture and its identification as a game (as an esport) that is collectively agreed to be the focus of a competitive community. Scholz [121, p.2] suggests:

> esports is esports and is a socio-cultural phenomenon rooted in sports, media, entertainment, and culture, but emerged in a digitized environment. Furthermore, esports blurs the barriers to those fields...esports evolved beyond the constraints of traditional sports, media, entertainment, and culture...

This socio-cultural perspective helps to explain why many competitive digital games are not considered esports. There are important distinctions to make between forms of vicarious play (e.g., Let's Plays [48]). The culture of spectatorship needs to regard a particular set of play forms, though it is debatable what these forms are. In a broad sense, they are recognisable as the forms of competitive play that lead to player skill becoming celebrated much like a traditional athlete's athletic skill [21]. Design principles to look for could include: multiplayer being standardised in a way that is fair and repeatable; winning being determined more by skill than by chance; the ceiling for mastery being high; and there should be performative qualities that lead to an "aesthetic model of dramatic dynamics" [144, p.16]. Many esports also demand paired cognitive and fine motor physicality [15, 56, 60]: focus, accuracy, reflexes, dexterity, and fine musculature endurance. More design principles likely exist, which preclude many games from evolving into esports. Furthermore, it appears that the culture of spectatorship needs to achieve a critical mass in scale; typically, forming an ecosystem of play at a professional level. Consider a hypothetical example of online social deduction games. Such games command a considerable livestream audience, but their mechanics—the rules that form how the game is played[2]—aren't suitable for formal competition, so they are not treated like an esport. Likewise, consider a hypothetical example involving a racing game. The game may arguably have sporting characteristics, with online leaderboards that champion world-record holders who elegantly execute complex maneuvers, but the game may also lack a large following, or an organised community and thus is not associated with any dedicated events.

Another aspect to consider is how industry relates to this socio-cultural phenomenon because innovation is still presently shaping what esports is. For the most part, the esports industry is involved in forms of media creation, circulation and consumption which, if not quite the same, is at least closely akin to the sports industry; notably, hosting events where spectators observe competition, usually with a focus upon highly-skilled players. The esports industry also functions to generate interest, support networks of social engagement at the amateur level, and train competitors. As is the case already with the sports industry, esports are becoming increasingly institutionalised [132], with organisations arranging events in which teams of highly-skilled players compete over prizes. Several esports now have multi-million dollar prize pools comparable to other sports (e.g., DOTA2 International 2019 - $34 million [43]). However, although sports and esports aren't necessarily objectively separate categories, there are key differences between their respective industries which influence how people engage with them.

Firstly, Hutchins [60, p. 851] argues that esports are "sports *as* media" due to the "seamless interpenetration of media content, sport and networked information and communications technologies". This means that the setup of events, the nature of broadcast, and the roles involved are starkly different. The focus is split by those who play, those who watch, those who produce, those who commentate, those who support, and those who

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[1]This group endorses the Associated Press [8] spelling of 'esports' with no dashes and without any capitalisation of letters within the word as it better corresponds to recent use in industry and general use according to search engine trends.

[2]Sicart [124] offers a more robust definition of game mechanics: "methods invoked by agents, designed for interaction with the game state" and gives further explanation.

sponsor. In esports, each of these foci overlap one another and a single person may be engaged across these areas, and for several esports that are being played at a given time.

Secondly, a considerable proportion of people watch esports via online platforms such as Twitch rather than television. The esports industry has positioned itself to take advantage of the flexibility offered by media technology to reach global audiences at relatively low cost. Many organisations are now involved in this ecosystem, operating in different areas and at different scales. Approaches and foci are varied, differing based on their origin whether grassroots, collegiate, institutionalised, or corporate efforts in different geographic regions [37, 81].

Thirdly, the sports industry is not concerned with the creation of new sports. Rather it focuses on the business, mediation, content generation, training, and research around the health, cultural, and psychological benefits of sports which already exist. Of course, there is indeed overlap in concerns surrounding standardisation, but the sports industry rarely has to 're-invent' games in the same genre, 're-balance' the primary rules of a particular game, or 'disrupt' popular strategies to keep the 'meta' of the game lively the way the esports industry does. The role of game developers here is nuanced. Few video games are deliberately designed as esports. One example could be *Overwatch* which was institutionalised in a planned fashion shortly after launch [132, 139]. However, becoming an esport is more often an emergent phenomenon [136]. This means some esports become actively recognised as such by their creators and maintained with consideration for their esport status (e.g., Blizzard's *StarCraft* [24]), whilst others are not (e.g., Nintendo's *Smash Bros.* [59]). Some games develop complex identities, incorporating aspects of esports (e.g., *eveSports* in *EVE Online* [25]). Others are diverging from archetypal computer game forms [33], particularly those leveraging immersive technologies (e.g., *HADO* [7]).

3.2 Why is Esports Important?

Growing out of competitive arcade cultures over the past fifty years [16], esports itself has been recognised since at least the late 1990s [140]. More recently the movement has grown considerably in importance in two key respects: culture and economics. Platforms, infrastructure, and multimedia streaming technologies have all matured and become widely adopted. Simultaneously, these have enabled esports to become increasingly democratised [128] and targeted by capital investment [74, 120] as public awareness grows. Reportedly, as television programming enters the 'post-network era' [86], esports is becoming more accessible and people are increasingly turning to streaming apps that offer esports content as a form of entertainment [137]. This is particularly driven by the proliferation of open-source tools (e.g., Open Broadcast Software [10]) that facilitate the livestreaming of esports and games, which in turn is driving a changed media ecosystem in terms of audiences and producers [27].

In some respects, these phenomena are a formative influence on young people in many regions. Taking the United Kingdom as an example, there is evidence of growing usage of platforms supporting this new media ecosystem [102], primarily YouTube and Twitch. Though esports is only a part of this ecosystem, being

adjacent to many other forms of streamed media, it is suggestive of a growing cultural movement that is capturing the interest of younger audiences.

Economically, the sector has already been booming in recent years [84]. Pennekeet [104] states that:

> esports is a rapidly growing form of entertainment scheduled to increase its global audience to 380 million this year. Of that total audience, 165 million tune in multiple times during the week and see themselves as enthusiasts. In 2018, esports revenue is expected to reach US\$908 million globally with North America contributing an expected US\$345 million. This is almost a 40% year-over year growth!

Ahn, Collis and Jenny [4] showed that global esports revenues surpassed \$24.9 billion in 2019, and it is anticipated that esports viewership will continue to grow following increased interest during the COVID-19 pandemic lockdowns [73, 76]. Forbes is even now producing lists of the highest-valued professional esports teams with Cloud9 topping the list at \$400 million [123]. Though the projected growth of esports has its critics. The growth of the sector is highly concentrated on certain esports and a relatively small number of companies [80].

Nevertheless, according to Newzoo [99], esports audiences had reached 495 million people by the early months of 2020. Though the figures are imprecise, they estimate that more than 1.6 billion people are aware of esports and this will reach 2 billion by 2021. They forecast audiences to grow to at least 580 million people by the conclusion of 2021. The *League of Legends* World Championship Finals had almost 100 million unique viewers, which for comparison was greater than the number of unique viewers watching the US Super Bowl [106]. Based on this, Newzoo [99] predicts that future events could have greater viewership than Rugby's Six Nations Championship, one of the most well attended international sporting events in the world.

3.3 How Does Esports Connect to Education?

The scale of esports culture and the size of the industry which supports it is now driving educators to consider the knowledge, skills, and attitudes that will be relevant to this new sector. Esports is appearing in many higher education institutions across the world [90], often in different ways and in different contexts [63]. In the United States alone, there are more than 2,000 higher education institutions that have competitive esports teams or recreational clubs [54]. With so many now engaging with esports through these and other contexts, a relatively high number of people are expressing interest in the career opportunities that it presents. However, there does not seem to be a widespread understanding of career prospects amongst university educators. The novelty and nuances of the industry make coming to such an understanding a non-trivial endeavour.

The broadness of the esports industry had lead to calls for action, with prominent business leaders arguing that commercial activities in this sector are not yet "studied in an adequate degree" [85]. Though the landscape is shifting [63], only a few esports education providers target roles and domains which are aligned

with industry needs, with many focusing on the wider business of esports. This leads to many questions concerning the role of higher education institutions and their effectiveness in supporting the esports industry. For esports curriculum plans to succeed, administrators and instructors must appropriately contextualize esports as a diverse and growing ecosystem of career opportunities, including the reality that professional game playing makes up only a tiny fraction of that ecosystem. As Anderson *et al* [5] illustrate in Figure 1, esports players comprise a small nucleus surrounded by many other types of professional roles that connect with many academic disciplines. Furthermore, the careers of professional players tend to be very short [116, 129]. Thus, strategies to support movement into other, more sustainable career pathways is a key consideration. Interestingly, though many such professionals want to remain in esports or pursue game development, a considerable proportion see STEM careers in their future [127].

Additionally, there are opportunities to leverage esports as a vehicle to help people to broaden their horizons and to diversify their skillsets [111]. For example, Lee & Steinkuehler [82] argue esports participation leads to connected learning in social-emotional domains, whilst Fletcher show it leads to improved well-being and personal growth [46]. There is considerable potential in the 'deep learning culture' that exists in esports teams [23] should it be exploited in educational contexts. Particularly, in learning transferable skills desired by employers in many domains [115].

In some ways the connection is reminiscent of the proliferation of games courses in higher education and the rise of game-based learning. Games are a means to attract and motivate students (e.g., [29, 65, 133]) as well as to support learning (see e.g., [1, 11, 17, 32, 72]). However, compared to games education, the interfaces across university departments will be even more complex. Training and education will span many areas including: game development; computing and technology subjects; live events management; psychological research; sports science; marketing; public relations; video (livestream) production; community management; in addition to coaching and communication. This crossing of disciplinary boundaries unveils a holistic connection between esports and education, which requires deeper consideration.

3.4 Which Individual Esports, and Genres of Esports, Should Educators Know Of?

Students are already aware of the most popular and most notable esports, and will expect staff at institutions purporting to offer an esports education to be knowledgeable of them. It is of paramount importance to avoid situations where learners feel they already know more than the educators who are guiding them. However, this can be challenging because there are many different esports to be aware of, and there is not yet a stable selection of pre-eminent esports. Law [80, p. 137] suggests that:

> [industry] statistics convey a very particular image of esports being well funded, [... having a very] large player base, [...] and overstated spectatorship figures. Although this suggests that esports is growing

> exponentially, we should acknowledge that this does not apply to all esports titles, but only for specific esports titles – currently...there are over 50 esports titles ranging from a number of genres...

It is therefore important to acknowledge there are many esports, and genres of esports, to be aware of, but that attention tends to be focused on a relatively small number; those which are seeing large economic growth due to their popularity. As such, it will be important to continually survey the esports landscape, with a focus on those which are growing rapidly. It is important to recognise that not all esports will be equally popular, and that popularity will vary by a range of factors including age, ethnicity, gender, and geographic region. Furthermore, as educators, another factor to consider is the breadth of genres within esports. It is worthwhile to become familiar with examples across the range of genres because smaller esports still make notable contributions to the field and to the state-of-the-art in esports.

It is also important to acknowledge that this is an evolving space, with new esports emerging each year. In recent years, the general public has grown increasingly accustomed to the digital versions of many sports (e.g., football in *FIFA*, winter sports including skiing and snowboarding in *Steep*, motorsports in *Formula E: Accelerate*, among others). However, Newzoo [97] reports a 'mobile-first culture', particularly in Asia, though mobile is even leading the way for amateur esports competition in Europe and North America. Titles such as *Battle of Balls*, *Clash Royale*, *Honor of Kings* and *Vainglory* are becoming widely known. This suggests that horizon scanning exercises should include popular releases on mobile platforms.

Generally, esports is a complex space and increasingly so. However, the EEDAR esports consumer analysis white paper [41] provides a digestible model. It divides esports into three main genres: 'MOBA' (i.e., multiplayer online battle arena), 'Shooter', and 'Fighter'. Collectively, they comprise the majority of all esports participation; respectively, being 77%, 62%, and 57% of the total audience. Other genres also exist, which the working group has labelled: 'Real-Time Strategy', 'Card Battler', 'Sports Simulation' and 'Miscellaneous'. They don't seem to have attained the same levels of popularity. However, they are esports which have remained prominent in terms of participation and viewership through the period 2015-2020, and which educators exploring this area should therefore become acquainted with:

3.4.1 Multiplayer Online Battle Arena (MOBA). These are third-person action titles in which two teams (usually, of five players) lay siege to opposing fortifications whilst defending their own. The objective is to destroy a critical structure defended by the opposing players, their computer-controlled allies, and static defenses. Each player commands just a single character which they select prior to the match from a considerable roster. Though general abilities and support abilities are often also available, it is typical for each character to have only a few abilities which are unique and limited to them. Considerable skill is required to use these abilities effectively, and as each cannot be re-used in quick succession, they must be deployed tactically. Within each match, characters improve their effectiveness as they defeat opposing forces, though these improvements do not carry over into future

sieges. Map design is a distinctive characteristic of the genre, typically dividing the play space into separate 'lanes' that connect opposing bases. Examples of this genre include: *League of Legends*, *Defense of the Ancients II*, *Heroes of the Storm*, and *Arena of Valour*.

3.4.2 Shooter. Esports in this genre have a very simple concept: players must eliminate their opponents using the weapons at their disposal; normally, firearms and other ballistic weapons. Though it might seem that digital interfaces lack the authenticity of real-world sharpshooting, merely demanding that players point and click, considerable skill is required to hit opponents. It is usually the case that players must rely on their own perception, wits, reflexes, dexterity, and familiarity with the characteristics of their particular choice of weapon to defeat their competition without being eliminated themselves. Shooter games offer a wide variety of modes, including: deathmatch (i.e., kill as many players as quickly as possible in a time limit); battle royale (i.e., being the last player or team standing); capture the flag (i.e, securing an objective and returning it home); escort (i.e., protecting an asset as it traverses a space); and more. Play is fast paced with very little time for players to relax, and whilst in some titles matches or rounds can be as short as a few minutes, others rewarding survival can run for 30 minutes or more. Many titles are team orientated, whilst some can be played as individuals. Examples of this genre include: *Counter-Strike: Global Offensive*, *Overwatch*, *Valorant*, and *Fortnite: Battle Royale*.

3.4.3 Fighter. The fighter genre involves two players facing each other in virtual hand to hand martial arts. Fighter games include a wide variety of different characters, each with varying attributes, appearances, and special moves. Typically, a visible meter tracks how much damage a player has received from their opponent, and a player loses when their damage meter reaches zero, where they are knocked out. Depending on the fighting game, a round can be as short as 30 seconds, although multiple rounds are fought to determine the winner. Many titles use a best-of-three format for a match, whilst others determine victory when one player has been eliminated a number times. Examples of this genre include: *Street Fighter V* and *Super Smash Bros. Ultimate*.

3.4.4 Real-Time Strategy. This genre concerns military strategy simulations played in real-time by two or more players who use a third-person top-down (sometimes isometric) interface to build and command units and structures to establish territorial control of a bounded area. Through warfare, players secure resources that allow them to expand. Victory is achieved when other players surrender or no longer control any structures. Typically, such games allow players to select from different factions which each play distinctly differently to each-other. Esports in this genre are known for demanding intense concentration because they combine hidden information with the need to concurrently balance macro-level economic and military strategy with micro-level management of unit tactics in skirmishes. Examples of this genre include: *StarCraft: Brood War* and *StarCraft II*.

3.4.5 Card Battler. These are collectible card games where two players duel one another, each using their own pre-assembled decks of cards which they play in turn. Typically, players must eliminate their opponent by reducing their life points to zero, although some cards may allow players to win in other ways. Players are limited in which cards they can play by resources that usually refresh at the start of each player's turn. The time of a round varies drastically; games might end after a few minutes, but sometimes can take longer than an hour to finish depending on the players' decks. Examples of this genre include: *Hearthstone* and *Magic: The Gathering Arena*.

3.4.6 Sport Simulation. The titles in this genre strive to simulate aspects of traditional sports. Not to be confused with single-player management simulations, these esports have players virtually compete with each other through forms of play that represent some real-world sport. Such simulations are not always one-to-one representations and are often adapted to the digital medium to improve usability and the player experience. Many thrust the player into the role of a single participant (e.g., a driver in motorsports), but others allow players to assume control over an entire team (e.g., every member of a football team through switching from one member to the next successively). Although many of the games are titled similarly to official sports institutions related to the simulated sport, they are not necessarily regulated by them and the connection is often brand-related rather than an explicit tie to traditional sports regulation. Examples include: *FIFA*, *Formula 1 Esports Series* and many others.

3.4.7 Miscellaneous. Some esports seem to elude classification, with one example being *Rocket League*. In some ways it is genre-defining, so it has been included here for coverage and to exemplify what may emerge in the future. It coud be said to simulate a 'hyperrealistic' version of an existing sport, reinterpreting it and taking advantage of the fantastical physics and complex automation afforded by a virtual simulation. Arguably, all esports have this quality to some extent, though a theoretical discussion is beyond the scope of this report. Nevertheless, it is distinctly different to sport simulations since, rather than as a technical constraint of the simulation, the rules diverge from its source of inspiration purposefully, warping play in ways that would be impractical to reproduce in the real-world. This is particularly important to consider as new such esports may emerge following the maturity of immersive technologies.

4 ESPORTS CONTEXT

"Esports" is not a homogeneous phenomenon, nor does it have a singular meaning. What the term signifies will differ among, for example, a young person avidly interested in esports as a pastime, a concerned parent worrying over their child's videogame playing habits, or an educator planning the implementation of an esports curriculum. From each of these different perspectives, esports takes on a unique set of meanings. For the young person, esports may be represented by enjoyable time with other like-minded individuals, the glamour of professional gameplay surrounded by thousands of fans, or becoming a well-known online personality with a large following [40]. Esports will likely be viewed differently by parents concerned about their child's physical and mental health, risk of developing internet or video game addiction, or future career opportunities. Educators will, in turn, need to consider these and a host of other issues in order to develop appropriate curricula. For example, should esports be
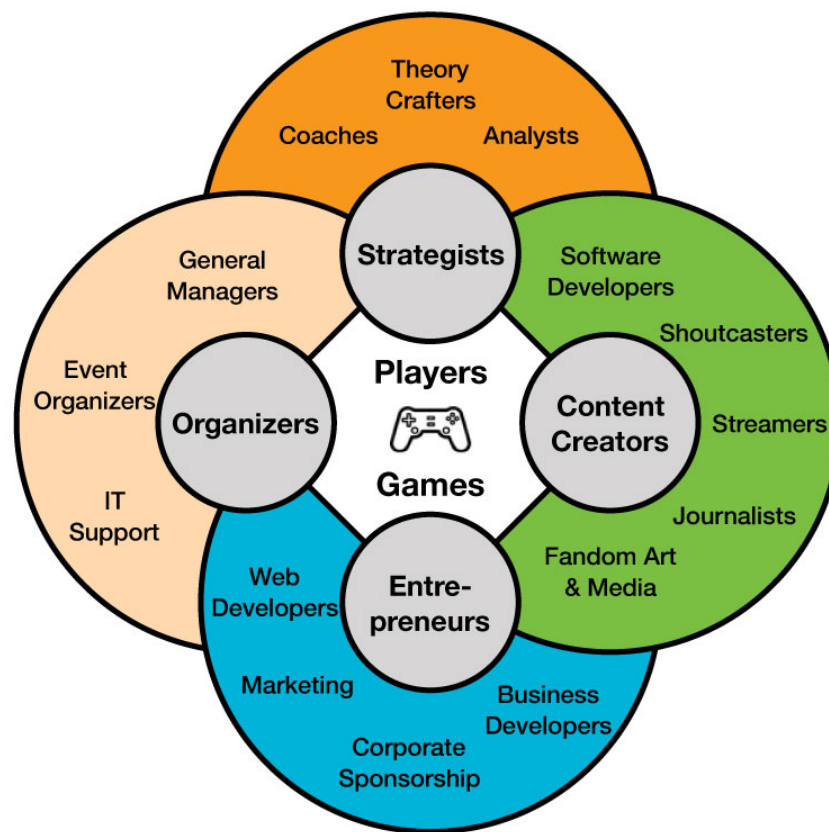
Figure 1: Careers possible in esports [5]

conceptualized in terms associated with sports, media and communications, computing technologies, business, or something distinctly interdisciplinary? Who is involved in the esports ecosystem and in what way? What cultural and ethical considerations may help guide an understanding of esports?

In light of these complexities, it is necessary to contextualize esports socially and culturally. Having defined and described esports in the previous section, in this section we contextualize the practice of esports, linking it firstly to the communities of play within which esports is situated, and secondly to the platforms and stakeholders that support these communities. This discussion then unveils further avenues to explore including ethics, values, and broader cultural impact.

4.1 Esports and Communities

Esports grew out of the avid enthusiasm of informal grassroots gaming communities, which themselves have multiple lineages. Face-to-face competitive gaming has a long tradition in societies around the world, going back millennia to games such as Go in China, Backgammon in Mesopotamia, and Chess in India. In a more modern context, fantasy-based competitive play emerged out of military wargaming [39, 126]. Its emergence coincided with the rise of fantasy literature such as Tolkien's *Lord of the Rings* and is exemplified in early titles such as *Warhammer*, a tabletop

miniatures game first published in 1983, and *Magic: the Gathering*, a collectible card game first published in 1993 that put in place an organized tournament structure for consumers known as the Duelists' Convocation International (today, DCI). During these same decades, computers experienced phenomenal growth, which enabled the emergence of arcade games and games for home consoles. Technology soon allowed personal computers in a single physical location to be linked together through local area networks (LANs) and gaming parties became common by the early 2000s [140], where players would connect their computers to play both competitive and collaborative video games. Taylor [136] argues that organised esports activities were made possible by the capacity for play over LANs and the general rise of the Internet in the mid-1990s. Where LANs allowed local groups to gather physically to play video games together, the Internet connected individuals and groups distributed over vast distances into networks of shared interests. Technological developments not only allowed those communities to play together online, but also made it easier to organise local, regional, national and eventually international competitions.

Taylor [137, p.136-137] characterises the history of esports as coming in three waves (though not necessarily occurring in a strictly temporal order): (i) the game wave, in which amateur and enthusiast communities dominated the scene for the love of

playing games themselves; (ii) the sport wave, which included institutionalisation and professionalization of gameplay, the development of translocal rulesets, and the normalization of legitimate organised competition; and (iii) the media entertainment wave, characterized by the refinement of media production and distribution methods as tournaments became entertainment events. The game wave swelled in the late 1990s and early 2000s in North America and Europe with the development and success on massively-multiplayer online games (MMOGs) and online first-person shooter (FPS) games, each of which promoted and supported competitive play through player-versus-player, achievement, and ranking systems. The so-called second wave is exemplified by South Korea's national development of videogame play as an institutionalized *sport*, also occurring in the late 1990s and early 2000s [28, 36]. Most recently and especially since 2010 in many countries, the primary emphasis among esports producers and organizers has shifted toward a media entertainment model; i.e., providing content for large audiences comprised of fans and viewers. These waves have come at a historically rapid pace and the esports landscape now comprises communities with varying interests and positions among these waves, from grassroots communities of play (including among student groups in secondary and tertiary educational settings) to corporate actors developing professional ecosystems that mimic mainstream sports media practices.

Arguably, communities of players and spectators comprise the core of esports as a social phenomenon. A major attraction for community members is spending time with others engaged in practices based on shared tastes [78]. While a large proportion of early esports communities would have been populated by active players or competitors, nowadays there are large audiences comprised of people who primarily spectate rather than compete or even play. As Law [79] notes, spectators themselves are interested in viewing gameplay for a variety of reasons. The growth in the proportion of spectators to players signifies the increasing time investment required to become a skillful, knowledgeable, and potentially elite or professional player. Although a relatively small core of the community, such skillful players, supported by an audience base interested in viewing competitive play, can transform local communities of play into more focused and professionalized esports scenes. However, several significant twists to the 'professional sports' analogy exist. These include the number of interested stakeholders involved the esports ecosystem (see Sections 4.2 and 5 below), the frequency at which new genres and titles enter the market, the speed at which those genres and titles can gain and/or lose popularity, the roles that various stakeholder play in the creation, development and support of various game titles and/or competitive leagues, and the legal terrains within which the broadcasting, consuming and sharing of game content are regulated.

4.2 Esports Platforms and Stakeholders

Although esports communities gravitate around players and spectators, it is worth considering the broader audience, their geographic location, as well as the various stakeholders operating in the spaces beyond small-scale competitive gaming practices. As

Figure 2: Key Arena in Seattle for DotA2 Tournament - Kevin Tao, 2017.

explained in Section 3.1, there is not yet a widely agreed notion of either the core characteristics or the boundaries of esports. However, the industry today may be well-characterised by the media creation and consumption surrounding activities that are similar in at least some ways to those of traditional sports. Events, for example, have been the bread and butter of traditional sports communities. Most cities around the world have stadiums or other dedicated spaces in which competitive sports are practiced, played and spectated by the public. Esports also have public events (see Figure 2), where large audiences gather to watch players compete live, however, due to esports' digitally-mediated nature, it is not necessary for players to gather in the same physical location in order to compete. In addition to public live events, esports also has a large and thriving existence on various digital platforms. Recent work has highlighted the growing significance of livestreaming [66] and pre-recorded content, which is produced, recorded, and broadcast online and which can be made available at any time of the day, season, or year. A key characteristic of streamed esports content that differs from traditional sports content is the ability for viewers to interact with esports players during or after broadcasts. This is visible in research on increasing popularity of Twitch and YouTube as platforms through which a majority of daily esports content is diffused. Given that these platforms are a major site of esports practice it is unsurprising that their corporate owners have a vested interest in guiding practice on those platforms and

engaging with the audience. There are multiple actors within the esports ecosystem who focus on various aspects of this process and at differing scales. The spheres of activity are diverse and draw upon a plethora of skills across a wide range of domains.

Esports content is normally broadcast live at various scales, from small-scale community events up to major international competitions. They can include entire days-long tournaments, individual matches that are part of a series or league of competitive events (sometimes broadcasts as episodes), singles exhibition matches, or a mixture of any or all of the above. It is rare for esports content to be uploaded to social media platforms without mediation or framing. Rather, it is produced for a number of different consumer options. For example: 'VODs' (videos on demand); highlight reels; post-match analyses; meta-discussions of the state of the game or gameplay strategies; reflexive discourse of community behaviour and values; or humorous, satirical content positioned as adjacent to, but typically aimed back toward, communities of esports players and fans.

Esports organisations initially sprung up around specific tournaments for specific games. Over time the necessities of institutionalisation have meant that individual esports games are overseen by a common rule set. Nationally and internationally the picture becomes quite complex given that the numerous esports which exist contradict the stated scope of many organisations. At least in terms of title and mission statement, many organisations see themselves as overseers of all esports in a national or international context, when in reality they will only play and organise events for a handful, usually the most popular, of esports.

The developers of a given esport have also been engaging with the financial and community growth opportunities more seriously since 2008 [136]. Companies such as Blizzard, Riot Games, or Supercell hire third party companies to put on and manage official esports events for their games liaising with dedicated esports roles or public relations and community outreach teams within the developer. These third party organizations host esports events, they do not own or publish the game(s) played at the event [96]. While the esports industry generates some revenue in this manner, media broadcast rights and advertising sponsorship are respectively the fastest growing and highest grossing forms of revenue [98].

Global esports media rights were worth approximately US$100 million in 2018 and predicted to be US$400 million by 2021, with Twitch reportedly paying Blizzard US$45 million a year for Overwatch media rights by 2018 [98]. However, even industry research bodies like Newzoo [96] have occasionally remained pessimistic about the benefit to developers:

> Illustrated by the increase in publisher fees from $105 million in 2017 to $116 million this year, esports is not a profitable business for game publishers and we don't expect this to change anytime soon

The first university based varsity scholarships in the US happened in 2014 at Robert Morris University when esports were recognised as a college sport [71]. Collegiate esports, some of which were supported by Blizzard through events like 'Heroes of the Dorm', were anecdotally found to be a successful way of engaging people in college activities regardless of whether they were familiar with the specific esport being played. The benefit of having familiarity with your college team acted as an effective gateway for collegiate esports to proliferate.

There is some controversy regarding sports regulatory bodies like the NCAA (National Collegiate Athletic Association) stepping in to regulate college esports given the emerging need for regulation and uncertainty about whether esports exists in the same space as traditional sports. This need for regulation on a national scale has led to organisations such as the National Association of College Esports (NACE) (with a membership of over 207 colleges and universities) in the USA and the 'NUEL' (originally National University Esports League) in the UK.

Baker and Holden's 2018 survey [12] on varsity esports identifies three categories of college esports: teams representing varsity programs; club teams; and privately formed recreational teams. So far, in the USA, there is no curriculum that exclusively teaches how to play esports. Instead, the focus seems to be on uniting existing student interest in esports with the educational context in which it takes place, ideally to position students to take on careers in the esports sector. Either way, the extracurricular context is as important to consider as the curricular context for the general student experience in this field.

4.3 Esports Ethics, Values, and Cultural Impact

Apart from the parties involved in either a professional or communal capacity, it is worth examining the cultural and value-based elements that any curriculum aiming to establish the context of esports must consider. Much like sports and games more generally, esports raises a number of questions about what values, philosophies, and ethical practices are encountered and advocated by their practice. Each of these topics are potentially vast, so the aim here is to provide an broad overview to raise awareness of the general context regarding cultural impact, ethical considerations, and values that esports influences and vice versa; particularly, in an educational context.

4.3.1 Graduateness. A key concern that emerges from the question of how to prepare students for industry roles is the eclectic and multidisciplinary nature of esports. One of the values to consider is thus how the graduate may be confronted with their own robustness in such a diverse field. Computing educators, in particular, have a role to play in nurturing critical thinking regarding esports. The industry supports a diversity of roles, each of which have multivalent considerations. However, they face many of the same ethical and operational challenges [89, 94] relevant to computing professionals, more broadly. Striving to preserve 'graduateness' in terms of reflective practice, scholarship, moral reasoning and lifelong learning (e.g., [130]) would likely lead to critical engagement with such challenges. It follows that the esports industry would then be driven towards positive, equitable, and sustainable models which consider the longevity and continuing change of the domain.

4.3.2 Career Readiness. The involvement of information and communication technologies in esports is sometimes emphasised and is one of the sites where transferable skills around the boundaries of the field might play the most prominent role within

education and training. There has been particular attention on developing STEM skills [5, 82]. Though, a game theory approach to esports could also foster esports as a tool to train "high speed strategic decision making" in management training, or other cognitively demanding real-time organisational tasks using digital technologies [129]. Smithies *et al* [129] have touched upon this challenge when considering transferable career options that exist, albeit specifically for esports athletes. The general skills requirement of esports players also overlapg with a broad range of aeronautic skills aligned with communication, and cognitive skills such as air traffic control, military drone operation, or piloting aircraft [129]. Transferrable people skills in esports have also been identified as a useful benefit from studying esports, albeit again in the context of playing esports, by Nielsen and Hanghøj [100]. They term one of the principal values to be derived from esports education as 'healthy game culture' which esports serve to convey as a medium.

4.3.3 Gambling and Addiction.
To some extent, esports has developed in the shadow of public and scientific concern about the positive versus negative dimensions of video games in everyday life. Research findings have suggested that younger players are "significantly more likely to sacrifice their education or work" to play games [49]. Because esports is such a new phenomenon, parents may see the possible negative rather than positive outcomes associated with supporting their child's interest in esports, especially given the enduring moral panic that surrounded video games and video game play in the 1990s-2000s [143]. In some cases, esports is seen as an unproductive and irresponsible pastime that risks young people's roles as productive citizens and family members [142]. Such a view relies on a rigid distinction between esports as a leisure activity versus a form of productive digital labor [51].

Newzoo [99] suggests that esports betting will become a large adjacent industry similar to sports betting with several companies already staking their claim in the space (e.g., Betway, gg.bet). In addition it is likely that the way in which friends and audience members engage with betting will be increasingly integrated into the 'viewership experience' by the games' developers. Riot Games has offered fantasy drafting which is a popular form of fan engagement when broadcasting League of Legends. Collective spending on esports betting may eventually surpass merchandise and ticket sales of live esports events [99]. Given the pronounced rise of gambling controversies in the games industry more broadly [58, 149], gambling and betting in an esports context will likely collide with mainstream esports audience practice, health concerns, and form part of its educational focus. This raises several ethical questions for those preparing students for careers in industry if they are to work in the emerging gambling sector of the industry: To what extent is it the responsibility of one working in the industry to raise awareness of ethical concerns regarding gambling? How might esports production practitioners reconcile with economic sponsorship or support from gambling companies? How might an international stream be legally compliant with gambling regulations in a variety of cultural or national contexts? How might one remain flexible to emerging or changing gambling regulations to preserve an ethical core practice?

The promotion of esports as a positive force is a challenge in several countries. Such efforts strive to overcome the prevalent notion that video games lead to addiction [62, 88]. To this end, frame analysis of promotional material in collegiate esports [88] establishes several frames through which esports values are mediated via educational advertising: purposeful activity; youthful activity; healthy activity; struggle for legitimacy. Positive values are made explicit since many of the advertising texts "specifically mention college esports as a route to a successful career, either as a player or a commentator" [88, p. 288]. Despite these attempts, the negative association with which some cultures perceive esports is a potential challenge to overcome when considering what value a curriculum might provide to the prospective student, and potentially their parents. On the other hand, such conservative perspectives are countered in areas where esports development is guided by pre-existing sports cultures and institutions that are more likely to be supportive of esports' potential for society and the individual player [68, 119]. Either way, esports have struggled with, and continue to vie for, mainstream legitimacy despite their commercial success so far.

4.3.4 Health and Well-being.
Physical health concerns exist despite mainstream skepticism about the *physicality* of esports compared to other sports. Repetitive strain injury, posture issues, and other health and safety concerns associated with the use of computer interface equipment are prevalent across most esports. 'Tense shoulders, focused visual attention, "on-point" posture, complex cognitive engagement, and stillness in the body except for the key interface points (eyes, hands, and even feet)...' [136] are not only evidence of the physically engaged nature of esports but also the site of numerous concerns for health. It can also be damaging to players' mental health to focus solely on the narrative of one's own success in-game to the exclusion of other forms of success [116]. Therefore, mental health and sports psychology are also relevant fields that are worth considering as part of the extended context of esports professional practice [141].

4.3.5 Reception and Regulation.
It seems clear that the cultural importance and popularity of esports is increasing, particularly with younger generations engaged with streaming media. This can be observed in many contexts, though the ways it manifests are dependent on some local cultural norms and practices. A comprehensive analysis of the cultural differences to inform how esports curricula might develop globally would be valuable, though such an analysis is beyond the scope of this paper. However, there are some specific issues that raise questions regarding how esports is received and the associated rhetoric.

It is worthwhile to consider the way in which cultural understanding and regulation of games intersects with esports. The Chinese esports market overtook the United States in 2016 as the largest esports market in the world. Symbolically, these nations have accepted esports. China, for example, invited an esports athlete to be a torchbearer for the 2008 Beijing Olympics and established a national esports team in 2013 [88]. Like several other governments, the hope is to stake a claim in esports while it is still in its early development. Though, the degree to which nations try to frame esports as a nationally-aligned pursuit is tricky. Those who play and watch esports may not necessarily see

it as a national pursuit in the same way traditional sports and Olympic events often are. It can also lead to alienation amongst an international audience where a broadcast is dominated by one nation's values or if the live chat starts to discuss sensitive political issues [62].

Stringent regulation of content and time restriction could also destabilise the future of any given esport. *Honour of Kings*, also known as *Arena of Valour*, is the most successful domestic esport in China. However, even this title has fallen foul of regulation. In particular, it has been criticised for its negative influence on young players (e.g., toxicity, addiction, etc.) [62]. Furthermore, although it is unclear to what extent any given esport might also be off-putting from a cultural perspective (see [131]), it seems that such restrictions stymie the growth of an esport. Ismangil *et al.* [62, p.64] note that *Honour of Kings*: "has separate streaming websites, separate forums and esports communities, news sites, and so on leading to a segregated audience which puts into question to what regard the government wants it to be international." As such, it is presently the case that Chinese companies do not own any of the esports that are popularly broadcast in international contexts.

More generally, the way in which video game ratings consider content, which vary by country, is also a challenge for mainstream broadcast and has been considered a potential risk for esports. Video games, as commercial products, are rated for classification, something that most traditional sports are not; though, there are notable exceptions including mixed martial arts and hunting which have age restrictions in many jurisdictions. Representation of fictional worlds in esports is a massive departure from traditional sports and has caused controversy where the ratings information of a game has influenced its suitability for television. The inclusion of revealing character costumes has been cited as violating ESPN broadcast standards during the broadcast of *Street Fighter 5* Finals at EVO in 2016 [50] and 2017 [95]. Ratings are also a concern for the recently proposed inclusion of esports as an Olympic event by the IOC who would prefer a representative game that does not include violent conflict [19, 20, 101].

4.3.6 Diversity and Inclusion. Many authors have called for an interrogation of values as they relate to inclusivity of esports in industry, community, and educational contexts. This inclusivity extends to issues of age [103], gender and sexuality [22, 80, 135, 137, 146], as well as race [45, 93]. Like traditional sports, esports are proving to be a site of political contention, and occasionally expression, for community members and interested stakeholders. Martin and Song [88] have noted how the rhetoric of esports must hail a 'multi-vocal' discourse that speaks to games, sports, and new media fans and participants as well as 'simultaneously to different stakeholders'.

Although overall industry reports about video games highlight the maturing age range of video gamers in their transition into adulthood, the discourse around esports in comparison is largely focused on the imagined audience of "young people" [103]. Esports media may not be entirely representative of a multi-generational audience given the focus on young athleticism. While players may often be young due to the physical requirements of playing esports at a high level since biological ageing impacts the competitive performance of esports players requiring "an almost eternal stream

of young talent" [103, 129], this excludes the reality of many players who compete in an amateur capacity or form communities around spectatorship and participation in esports.

Despite the technically egalitarian nature of esports rule sets which generally do not discriminate, discrimination still persists through gender stereotyping and exclusionary gate-keeping practices both formal and informal [80, 136, 146]. While female players are not forbidden from competition or bracketed into a separate division, playing esports passionately requires that they navigate stereotypical ideas of identity such as the 'gamer girl' and public identity politics generally [80]. Esports culture is also wrapped up in gamer culture which has historically been a male-dominant space and slang used in these spaces, that is endemic to esports subcultures, prominently features various discriminatory slurs and acts of toxicity [80]. Female players can, to a limited extent, avoid personal harassment by playing anonymously online, but engaging with the hobby publicly (which is ideally a non-problematic option) is made difficult by cultural and subcultural norms. Witkowski [146, p. 129] highlights the gender and class issues that have been inherited by esports organisations such as MLG (Major League Gaming) through their adoption of (particularly American) sport's hegemonic masculinity.

Egalitarianism is a major topic within sports discourse generally, especially around women's sports in the modern age [137]. Physiological sex differences are overstated within sports, and esports offers a chance to radically change this idea. The 'muscle gap' or 'biology-as-destiny' argument does not really hold up in most cases and it would make sense to bracket competition by skill or emphasise participation, rather than bracket by gender or sex as has been done traditionally in sports. Taylor argues that hegemonic masculinity which defines the identity of sporting athletes also primarily defines the esports player who sees themselves as an athlete 'minus the emphasis on physical qualities' [136]. While mixed-sex teams within esports are appropriate and there is no real reason for the exclusion of genders within competition, it happens because of the cultural attitudes and practices surrounding esports. One could argue that if esports is to become mainstream it must take on this hegemonic masculinity even more so to become successful which presents a risk for the perpetuation of values that would prevent inclusive practice and maintain a homogeneous demographic within potential student cohorts. Inclusive practices may also include those with physical disabilities that may not otherwise easily participate in traditional sport, but the virtual nature of esports permits participation for those individuals (with modified gaming equipment if needed) without the need for a paralympic bracket or similar.

Anykey is perhaps the most prominent advocacy organisation that supports diversity in esports community development, livestream moderation, and offers guidance on codes of conduct for holding tournaments [80]. The British Esports Association's 'Women in Esports' initiative as well as Women of Esports, FemaleLegends, and Women in Games offers similar guidance and these initiatives can provide insight into embedding inclusive values into curriculum [9]. Esports has the potential for radically inclusive philosophies that could be explicitly reflected in and advocated by an educational curriculum. Especially one that seeks

to secure ethically-minded individuals stable careers in the esports workforce. While some suggest esports is best placed to do this at the grassroots level of community [80], education could be a potent ally in embedding a more inclusive and critically self-reflective set of values. It also seeks to address another major area of toxicity and bullying within esports, which is the pervasive negative response to beginner or less skilled players [61]. Creating an inviting and welcoming space to welcome new audiences is in the best interest of the industry, and is a priority for several publishers of esports, but remains a considerable challenge in most esports.

Esports is also primarily practised by those living in countries where it is easy to purchase and consume video games, and even within these countries it is typically more accessible to the middle and upper class given the relative costs of hardware required to run esports. Although initiatives speak of esports' global nature, esport competition is still regionally limited by issues of latency and quality of available hardware.

Through a broad, contextual examination of esports, it is clear that the various domains of esports must be given fuller consideration so that a given curriculum might accurately reflect and address them. Although education and careers in industry are a focus for present directions in developing an esports curriculum, it is necessary to consider the social context in which esports exists and has existed before colonisation by industry, research, and education. Given the plurality of interest in esports as a field as well as the overlap between various disciplines required to practice esports, organise events, and bring them to an audience, there is considerable entanglement that curriculum designers need to acknowledge.

5 ESPORTS CAREERS

The simultaneous development of online video game platforms and services, the increase in global internetworking infrastructure, as well as improvement in computer processing and storage capabilities, have all stimulated the growth of digital media platforms that facilitate content sharing. Such digital media platforms have helped esports become an increasingly common aspect of productive and consumptive practices [52]. The growing availability of esports content coincides with both growing support from industry [120] and increasing numbers wanting to pursue careers within the larger esports ecosystem [13].

Once considered niche, since the turn of the 2010s esports has become a complex global entertainment phenomenon. The most visible role, of course, is being a player, which at least for a small minority of people enables them to earn a living by competing. However, following on from the ecosystem proposed by Anderson *et al.* [5], illustrated in Figure 1, this professionalization is not limited to players. Esports players make up a small nucleus surrounded by a considerable range of roles, each with different competencies, which connect with many of the academic disciplines discussed in this report. Thus, representing the ecosystem in an educational context must go beyond professional play and include the labours of esport development, organisation and technical skill, as well as broadcasting and streaming, and any other professional strands that exist in the esports industry [67].

Esports careers are a primary consideration for determining how the market may meet the demands of prospective esports students, graduates, and industry.

If, until recently, esports was mainly carried by self-taught multi-tasking volunteer enthusiasts, the constant growth of the phenomenon has gradually led the various stakeholders to: *(i)* seek new skills, often drawing together disciplines such as technology, sport, and media; *(ii)* increase their human resources; and *(iii)* surround themselves with increasingly qualified people. Today, working within the esports industry is a dream for many young people, however it is sometimes difficult to perceive what the possibilities are in terms of job opportunities, and therefore indirectly, in terms of educational pathways.

Here, extending prior work shown in Figure 3 [14], numerous professions related to esports are presented in order to: *(i)* show the different esports career possibilities; *(ii)* reassure worried parents that their children want to make a career in esports; and *(iii)* help educators and their institutions to identify, and begin to classify, the career pathways they need to focus upon.

5.1 Career Pathways

5.1.1 Performance & Health Management. First of all, in order to evolve in an environment that favors performance, the player is surrounded by more and more support staff to aid healthy performance. Esports clubs have begun to deploy resources to support the player towards a high performance level and success. Roles include:

- Head Coach
- Video Analyst
- Data & KPI Collector & Analyst
- Team Manager
- Physical Trainer
- Performance Psychologist
- Wellness & Mental Coach
- Dietician & Nutritionist
- Physical Therapist
- Sport Medicine Physician

The coaches and analysts (and, in particular, video analysts) are responsible for technical and tactical training sessions. The manager is in charge of organizing the different timetables of the players (training, meals, sleep, free time, travel, etc.). To support performance and maintain players' health, the teams also rely on physical trainers, performance psychologists, dieticians and nutritionists, as well as physical therapists. Their mission is to offer appropriate tools to each player to support them in their quest for victory.

5.1.2 Esport & Organisation Management. Esports players represent a club, which is a collective of players engaged with esports. Its organization requires a multitude of skills that strive to nurture talent and secure income. Roles include:

- Executive Officer
- Head of Esports
- Head of Scouting
- Agent

Figure 3: Esports related professions [14]

The executive (CEO) manages the daily organization of the club, the esports director (Head of Esports) defines the global strategy of the club (e.g., which games to compete in), and the scout (Head of Scouting) seeks potential future players who could join the teams in the coming months and years. At the same time, the career agents complete the needs of the players by helping them to enhance their image, negotiate contracts, and define their career path.

5.1.3 Events Organisation. The main function of esports clubs are to facilitate the performance of players so that they participate in competitions. Esports events require many resources. Events organisation roles include:

- Event Director
- Event Project Manager
- Event Producer
- Administrator / Referee
- Observer
- Runner
- Translator

The event director is responsible for the proper conduct of the competition. The event project managers define the strategy and requirements while ensuring the collaboration of the many stakeholders. The referees and admins ensure that the tournament runs in accordance with the rules that have been set up beforehand. The runners are the constant link between the teams of players and the team of organizers acquiring anything they need. Finally, the translators make sure that in international events, each team and each player gets all the necessary information.

5.1.4 Presenting. The esports ecosystem and its events rely on the skills of many actors who host the events and present matches to an audience, often live with commentary. Roles include:

- Caster
- Host
- Streamer / Video Maker
- Desk Analyst

The 'casters' (i.e., broadcasters, commentators) must explain the actions in real time, making them intelligible to all the viewers. The host, operating on a physical stage, act as a master of ceremonies ensuring continuity and coherence of the live event. Between matches, the desk analysts verbally deconstruct the actions for the audience that have have taken place and stakes of the next matches. Finally, players can also create their own content by streaming their training sessions or even by making tutorial or behind-the-scenes videos.

5.1.5 Broadcast Management. Competitive esports events are often broadcast live on streaming platforms such as Twitch. Thus, skills related to video production are required. Ensuring this goes smoothly involves multiple roles, which include:

- Broadcast Manager
- Live / Video Producer
- Broadcast Distribution

- Stream Director
- Stream Monitoring
- Replay Operator
- Cinematographer / Camera Operator
- Graphic Operator / Live GFX
- Stage Manager
- Set Assistant

The broadcast manager and the live producer are assisted by the video producers, stream directors and replay operators who ensure the success of the broadcast. The camera operator has the duty to capture the visual immersive images of the event, while transcribing the atmosphere on the site and propose immersive images, while the graphic operator manages visual elements that help to contextualise and clarify information in the broadcast. Many people are also active on the set to assist the players and teams, typically requiring a stage manager to coordinate, and set assistants who communicate with the production department.

5.1.6 Information Technology. The quality of these events depends largely on highly technical skills from the information and technology professions. Even when players compete on-site, the competition takes place in virtual worlds to which they connect. Roles are varied, but some examples include:

- Network Architect
- Systems Engineer
- Technician
- Light / Sound Engineer

Network architects and network technicians play a major role in players' seamless gaming experience. Network engineers are responsible for providing network security and stability, while light and sound engineers ensure the best possible image and sound quality.

5.1.7 (Digital) Communication & Marketing. Esports competitions are also a show that must be profitable. Organizers rely on resources from the marketing and communication professions. In an increasingly digitalized society and in an intrinsically digital sector, the skills required in these professions are related to this field, including:

- Social Media Optimizer
- Community Manager
- Traffic Manager
- Web Designer / Developer
- (3D) Graphic Designer
- Content / Post / Video Editor
- Digital Marketer
- Brand Manager
- Head of Partnership / Sponsoring
- Trade Marketing / Merchandising
- Head of Product / Advertising
- Head of Licensing

For communication, social media optimizers and community managers define the strategy and wording to be used on social networks. They are complemented by traffic managers, as well as graphic designers and video editors, while each event is supported by a website created by web developers and designers. For marketing, the objective is to define the best strategy to propose a relevant product for partners and customers. This is the role of the brand manager, head of partnerships, head of licensing or head of sales.

5.1.8 Support Functions & Services. All professional esport stakeholders also rely on numerous support functions. There are, of course, many products and services which esports companies need to procure and maintain to conduct business. Notable overarching roles at the commercial level include:

- Business Developer
- Rights Purchaser / Reseller
- Head of Areas
- HR Manager
- Recruitment Officer
- Training / Mobility Manager
- Financial Manager / Analyst
- Budgeting Manager
- Accountant Treasurer
- Legal Manager / Counsel
- Lawyer / Attorney
- Software Supplier
- Hardware Supplier
- Apparel Provider
- Facilities Provider
- Insurance Provider

The business developer's mission is to find new growth opportunities for the company. It is also often the case that game licensing rights need to be negotiated to broadcast esports. Heads of their respective areas handle the operational aspects of the business which crosses multiple areas. At the human resources level, the recruitment officer searches for and finds candidates who meet the company's recruitment needs. At the financial level, the budgeting manager develops budgetary strategies to increase the company's profitability. At the legal level, the Legal Manager safeguards the interests of the organization by legal means (e.g. legal assistance to HR, protect company's intellectual properties (IPs), prepare legal notices to clients, etc.). The Hardware Supplier creates specific controllers and practice equipment (keyboards, mice, headsets, etc.). The Software Supplier develops online coaching or tournament management platforms. The Apparel Provider offers specific clothing for the comfort and performance of players. The Facilities Provider, such as gaming bar franchises or network game rooms, offers bootcamp rooms.

5.1.9 Esport Development & Maintenance. There are of course the range of companies (e.g., Epic, Riot, Valve, Blizzard, Tencent, etc.) that produce and maintain the esports themselves, often in conjunction with third party companies as well as prominent community members and organisations. Many esports are expansive and updated on a regular basis, typically to enhance or re-balance play. This means that roles in development and maintenance exist, including:

- Data Engineer
- Analyst
- Product Lifecycle Manager / Game Producer
- Designer
- Artist

- Programmer
- Specialist Developers (e.g., Artificial Intelligence)
- Software Engineer
- Balancing Manager
- Software Architect

Data engineers embed metrics into esports to collect information about the state-of-play they investigate. Analysts make sense of this data, taking into consideration the insight of the digital communications and marketing professionals, such as community managers, who maintain a connection with the community. This primarily includes the people playing their esports, whether at a professional or amateur level. In reviewing metrics and discourse in the community, they are able to identify future directions for their work. This is directed by product managers and producers. Typically the work itself is taken on by designers, artists, and programmers who propose, scrutinise, and implement changes, which usually involves re-balancing gameplay. Often, more specialised developer roles are called upon; for example, in areas such as artificial intelligence where machine learning techniques may be deployed for tools that support esports (e.g., engagement detection in replays for video analysts).

5.1.10 Education. With the numerous grassroots esports clubs and the emergence of numerous academic programs dedicated to esports, the jobs related to education also constitutes a need. The roles include:

- Course Manager
- Instructional Designer
- Educational Technologist
- Educator
- Lecturer
- Researcher

Managers lead educational programmes, often taking responsibility for curriculum, delivery, and quality assurance—often liaising with industry to ensure relevancy. Designers support the learning journey, working with course managers to set out the structure of educational programmes and advising on pedagogies appropriate for maximising learning in content domains. Technologists support the development of e-learning and virtual learning environments and sometimes develop new educational technologies. Educators are responsible for delivering courses adapted to the academic study of esports and the training needs of the esports industry. In the case of researchers, they must also lead research programs that are useful for increasing knowledge about the sector, typically meeting the needs of stakeholders whilst also feeding back into curriculum development. It is hoped that at least the course manager, educator, lecturer, and researcher all have esports expertise, whilst the instructional designer and educational technologists insight into e-learning norms of different disciplines as well as into the suitability of educational technologies and approaches to applying educational technology effectively in the learning domains that would be relevant to esports.

Table 1: List of Top 30 Esport-Related Companies Posting Job Adverts Online in June 2021

Company	Count
Ubisoft	157
Activision Blizzard / Blizzard Entertainment	84
Riot Games	66
Electronic Arts	55
Sony PlayStation	36
Gameloft	25
Keywords Studios	21
People Can Fly	19
Twitch	17
Skillz	16
Epic Games	15
Garena	14
31st Union	14
King	13
Raven Software	11
Wargaming	10
Codemasters	9
Freaks 4U Gaming	9
Semper Victories Esports	9
Infinity Ward	8
Wizards of the Coast	8
2K	7
Funcom	7
ONE Esports	7
Amazon Game Studios	6
ESL	6
Fnatic	6
META Games	6
PUBG Corporation	6
United in Gaming	4

5.2 Industry Need

Popular job search engines, including *Hitmarker* and *Rektjobs*, are often used by students and job seekers to gauge and apply for esports careers. They are considered two of the most popular search engines for esports careers, although numerous others exist. These were selected as starting points to determine the level of industry demand for the roles that the working group have identified and what the employer expectations may have be for certain positions. Though, being English language job sites, a limitation is that they will not likely be representative of global demand, and more so of demand in English-speaking countries.
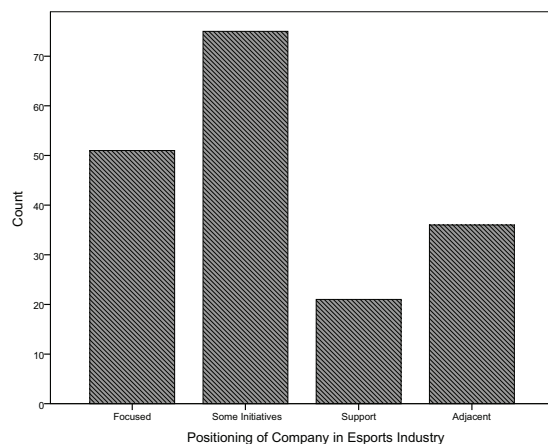
Figure 4: Positioning of Companies in Relation to Esport Sector

In total, there were 1,533 roles in the dataset[3] that were listed on these platforms on 25th June 2021. The working group identified 347 companies advertising roles. The jobs were classified into the schema presented in Section 5 by two raters who deductively coded the data. Agreement between the raters reached 93% for the jobs and 98% for companies, with disagreements resolved through discussion with the rest of the working group. This analysis was then extended to identify those companies which could be considered esports companies and to what extent they were positioned in the sector—classifying them as: 'focused', where the company was largely focused on esports, with it representing the core of their business model; 'some initiatives', where the company had strong involvement in esports as a clear part of its business but did not operate exclusively in the esports sector; 'supporting', where the company produced products, including platforms and tools, that actively supported the esports sector, or exclusively offered services that were tailored to the esports sector but that might not be considered an esports initiative in itself (e.g., marketing, sponsorship management for clubs); and 'adjacent', where companies had dealings with the esports sector and appeared to do business with other esports companies, but served many sectors and did not specialise in esports in any meaningful way. Where it was not clear that a company were involved in esports or have any clients in the esports industry, they were marked 'out of scope'. The results are shown in Figure 4.

Once the data had been coded, it became evident that further exclusion criteria should be applied as although the data had been collected from job sites that claim to specialise in the esports industry, many of the jobs listed did not fit clearly into the esports sector as defined by members of the working group. This was the case for many game development companies and many start-ups which did not have any publicly evident involvement in esports. Furthermore, for those companies with 'some initiatives' it wasn't always clear from the job advert whether each role was specifically

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[3]For reference, data is available at https://falmouthac-my.sharepoint.com/:x:/g/personal/michael_scott_falmouth_ac_uk/EeeWl9I-X3FAvrEDIH0_vFkBR4AE_p7-ZP2yoUGG7so7yw?e=9y9R6b

tied to esports or instead would support a range of digital products and services across their portfolio. Where it was not reasonable to infer this confidently, cases were excluded. Further complicating this were those companies that did not self-identify as being supporters of esports despite their products having a large esports scene, but it was decided to include such cases. Following further discussion, it was also decided that roles working on 'unannounced projects' should also be excluded because they were often ambiguous even in cases where the companies were considered 'focused' on esports and so the link to esports could not be determined.Following the screening process, this meant that subsequent analysis focused on the remaining 984 job adverts from 183 companies. Of which the top 30 recruiters by number of posts represented 69% of the available roles. A summary of these is provided in Table 1.

Demand according to the domains identified by the working group in Section 5.1 is summarised in the bar chart in Figure 5 above. Figure 6 on the following page gives an impression of the job titles in the dataset. The development and maintenance of esports commands a considerable share of the available career pathways in the esports industry. It is worth noting that these jobs are varied in terms of discipline, with an apparent demand for animators and software engineers.

The management of an esport game title was the next most frequently type of role advertised. The specific roles were evenly spread across product managers, producers, and data analysts who were evaluating the impact of an esport and plotting its future course. There was considerable overlap with areas including machine learning and data warehousing, which overlapped potentially with information technology (IT), but where such roles emphasised insight and domain-specific knowledge rather than tools competency, they were considered here.

Following from this, there was considerable diversity in information technology roles, going from network technology and cloud computing, cybersecurity, and back-end software engineering, through to technology support, business information systems, and e-commerce. There was some overlap with 'digital communication and marketing' roles as web developers sometimes focused on back-end servers, infrastructure, or web applications in which case they were classified as IT, whilst front-end and graphic design for the web were classified as digital communications and marketing.

Content developers were prominent in digital communication and marking, followed by social media strategist, and talent manager roles. A considerable proportion of roles involved in the production of video content for esport casters alongside marketing activities. Content production was considered here, though there were a minority of advertised writing roles which were unrelated to a company developing esports or supporting esports events and so were instead classified as journalism.

Within Esports and Organisation Management the management of clubs was surprisingly sparse given the focus of the industry on professional players—with most of the roles found being incubation, acceleration, talent scouting, or senior corporate roles in companies related to esports. It is perhaps the case that different hiring norms for such roles exist, perhaps with many teams being
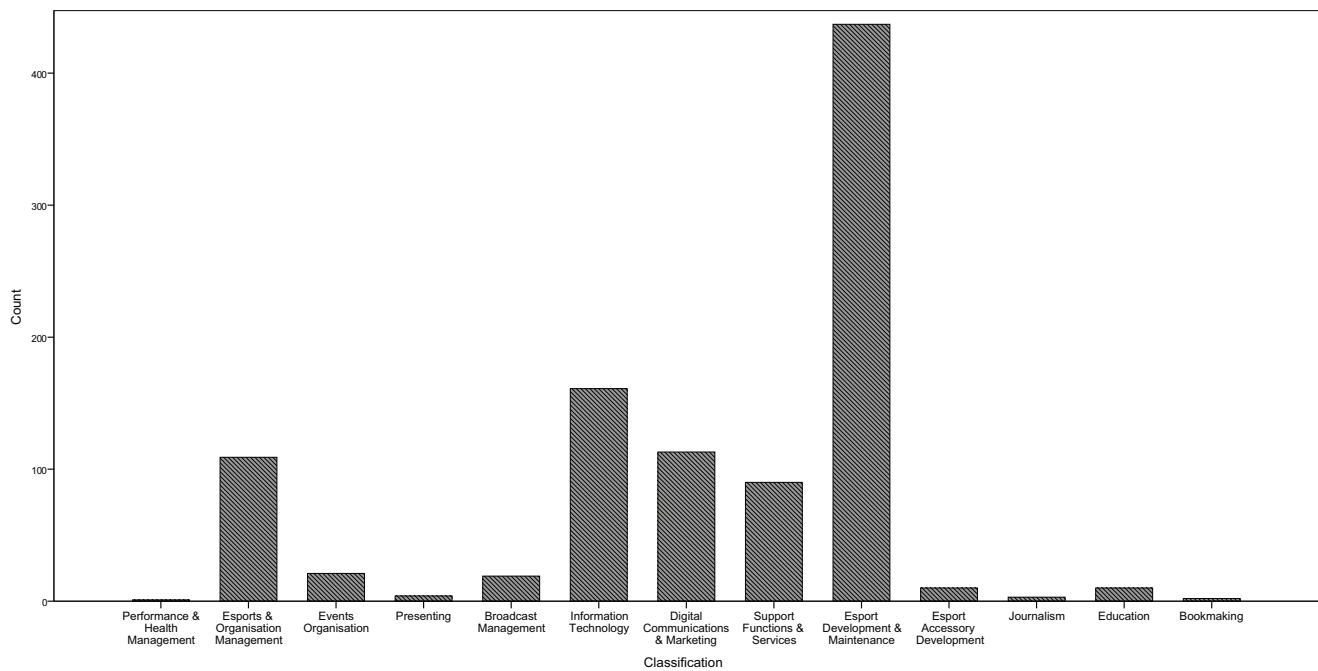
Figure 5: Bar Chart Showing Industry Demand Relative to Role Classifications According to Job Search Engines

Figure 6: Word Cloud Summarising Job Titles According to Job Search Engines

setup by entrepreneurs or ex-players, and so the advertising of such roles on job websites is perhaps less pronounced.

Broadcast management and events organisation were broadly as expected given the current climate of COVID-19 pandemic lockdowns across the world (with Riot's broadcasting and events in Asia representing many of these roles). It was seldom the case that presenters were actively sought for. Instead, these seemed to be management and outsourcing positions, suggestive that local labour is hired as required and drawing upon supporting organisations to setup and coordinate the actual events. Additionally, the adverts in this area were content creation talent programmes, meaning that one advert might represent many roles in this area, under-representing the opportunities in these areas.

Education was also modest, but as expected included universities, training companies, and organisations promoting STEM outreach via esports. This may be because many of the large higher education employers in the USA and UK do not use esports-specific job search sites. Instead, jobs are often posted to *HigherEdJobs.com*, *Jobs.ac.uk*, *The Chronicle*, and *Times Higher Education.*

A surprising trend was the low number of performance and health management roles on these job search platforms. Regardless of the demand observed by this working group, however, there is a clear rationale for the inclusion of performance and health professionals in esports. The working group is aware of a number of pioneers in this area, including companies such as *GScience* in the UK, which are the official performance and health partners of several esports talent agencies. Many esports clubs such as *G2 Esports* were found to actively advertise roles in this area, including performance coaching. Though it is unlikely that healthcare radically differs between sports industries and the esports industry, and that mental-health concerns will also be similar due to the similar needs of young athletes, each specific esport will come with its own specific healthcare needs. The range of fitness and risk of injuries will be different between cricket, football, *StarCraft*, *League of Legends*, snooker, basketball, and so on. This suggests that rather than there not being a need or demand for healthcare and coaching roles in esports, that these roles are being recruited elsewhere, either from less specialised recruitment sites or informally as part of community esports networking.

It could be the case that not all roles are yet prevalent in the job search engines selected. This might be because there is considerable overlap with sports companies and so companies may be using existing platforms to recruit such professionals, or the hiring norms of this disciplinary area are such that the use of online job websites is less pronounced. Some articles suggest that ex-players transition through informal channels into coaching roles [116, 134], and so it could follow that teams searching for people with these skills will go to generic coaching, nutrition, or sports psychology agents.

It could be seen that career opportunities in esports vary greatly across the esports ecosystem. There are currently careers ranging from the management and business sector to: coaching; wellness, nutrition, and performance management; content creation and media production; game design; computer science; and more. Esports represents a multidisciplinary area of study which extends to the variances in esports careers across the ecosystem. However, it is interesting to note that a surprisingly considerable proportion

of the roles being advertised in this field require computing skills, particularly in the areas such as data analytics, software engineering, and user experience design.

Aside from the limitations of the data presented in this report, it is also important to consider that the current landscape of careers in esports is not an accurate depiction of the total space as there are potential opportunities that may exist in coming years that have not yet been created. Predecessors to currently the most popular streaming platform, Twitch, such as Justin.tv (which became Twitch.tv) and Ustream were not primarily intended for streaming games. They were "social cam" websites which allowed people to stream a variety of content that was not game oriented [137]. Since Twitch's development from Justin.TV in 2011 the site has become entirely dedicated games although unusual streaming categories have been growing in popularity in recent years such as "just chatting", "art", or most infamously "pools, hot tubs, and beaches" [38, 70, 87]. Furthermore, there may not yet be stability as the esports space, much like many esports consumers, can be independent and entrepreneurial in nature. Individuals looking to work in esports, outside of being professional players, may look to create their own role in the space (e.g., starting an esports organization).

The widespread streaming and spectatorship of people playing video games or other forms of entertainment on platforms (such as Twitch) that grew along with esports was somewhat unpredictable ten or twenty years ago. So it is worth considering what developments may happen in a space that is still growing. The esports space, much like consumers of esports content, are largely independent and entrepreneurial in nature. Individuals looking to work as a career in esports, outside of being professional players, often look to create their own role in the space. This can be in terms of creating content, starting an esports organization, or some other venture.

Betting and esports gambling is still in its early stages and was not prominently referenced in the data, most likely due to developers (i.e., the most frequent hirers) unlikely wanting to associate with gambling due to recent controversies (e.g. illegal skins betting [58], lootboxes and gambling [149], etc.). There was only one role in the dataset (i.e., 'Esports Trader') and it was related to analysis of professional-level esports play in order to determine appropriate odds for other betting companies.

These findings broadly accord with industry reports, such as the one published by Hitmarker [57]. Though the schema for classification is different, and it is unclear whether the inclusion criteria differ, the results highlight the high demand for software engineering and marketing skillsets, followed by design, operations, sales, and business development, with a long scree of other disciplinary areas. Some roles such as events, community management, and product management, remain a relatively small proportion of the overall number of positions advertised by these services; despite their importance to the sector. Similarly, certain areas such as healthcare were also under-represented.

The titles of jobs, currently advertised, conservatively target prospective employees which likely speaks to the demand for multi-skilled individuals but more notably the relative immaturity of the industry which has yet to define its roles with more specific terminology. It is also unclear to what extent many of the roles

required are unique to esports and where job roles could easily be filled by those transferring from other skillsets aligned to different industries such as television broadcast, graphic design, network engineering, events management, or showrunning. In broaching the question of 'what are employers looking for?' it is difficult to provide a complete answer at this point since the jobs advertised are very different in terms of skillset and the employers asking for them are very different in nature. Some of the roles technically reside in distinct sectors, and so esports does not form a neatly monolithic industry. It also can't be definitively said that existing computer science, games, or events management degree students might not adequately meet the required skill sets of some of the job roles listed. Again, it must be emphasised that the industry may still be immature and not as formally developed as much older industries with which esports overlaps.

Players, presenters (or shoutcasters), analysts, and other 'on-screen' talent are job titles unlikely to be recruited via regular channels, usually having managers who mediate esports events work on their behalf or are individuals prominent enough in their community that the job role is naturally filled by those with high cultural capital. Likewise, it is possible that many roles in organisational management in esports teams are not widely advertised and may instead be promoted within the communities where the events and competitive gaming is taking place. Many such roles could also be entrepreneurial, with people assuming these positions when they found a team or a company.

6 ESPORTS EDUCATION

Esports education helps connect students in higher education to potential career opportunities in multiple ways and into a number of different areas in the esports ecosystem, as well as areas outside of esports. Many courses have emerged in the last 3 years across the world, and provide a basis for educational achievement and understanding. This education can give potential employees an advantage in applying for jobs as they are able to draw on their education, as well as passion and any relevant experience, in applying for jobs. However, the current state-of-the-art in esports education is not broadly understood and is, in many respects, emergent. Following from the survey of career opportunities, the working group set out to assess the extent to which current esports courses align with industry expectations.

Starting with the higher education courses included in a previous review [63], the working group identified 65 higher education courses catering to the esports industry, gathering publicly available information and assembling a dataset[4]. In the interest of scope, courses that focused almost entirely on games development were excluded from this sample. This is because the group identified a considerable number of such courses (> 500) with most having only a tangential link to esports or did not explicitly mention esports. Of the 65 esports courses, 29% were arts-related, 37% were science-related, and 34% were awards in business administration. There were 15 at postgraduate level, and 50 at undergraduate level. Nearly all of the qualifications at

postgraduate level were either a generalist conversion course for people interested in directing their career towards esports or an MBA course with a focus on the esports industry. Of the undergraduate courses, the majority were at Framework for Higher Education Qualifications (FHEQ) Level 6, the international standard of a Bachelors degree. There were five courses at FHEQ Level 5 (Associate degree) level and two at FHEQ Level 4 (Diploma or Certificate). Titles varied but the most frequent were: "Esports" (11 occurrences); "Esports Management" (10 occurrences); and "Esports Business" (3 occurrences). Most courses had some combination of terms such as "E-Sport and Competitive Computer Gaming" or "Esports Economics & Management".

6.1 Coverage of Career Pathways

Esports curricula are already being developed across a variety of disciplines in secondary and tertiary educational institutions, including English Language and Arts (ELA), Science, Technology, Engineering and Mathematics (STEM), career-technical education (CTE) [83]. However, excluding the rather considerable number of game development degree programmes which exist and the subset of those which directly address the development and maintenance of esports, most degree programmes in esports tend to focus on the business aspects of the esports industry; notably, organisational management and business. Figure 7 illustrates the career pathways that existing courses address. It is clear that organisational management as well as support functions and services are most prominent. Areas including digital communication and management, event organisation, and broadcast management were also well-represented, as expected. It was anticipated that areas like education would not have specialist courses and that betting was too niche to yet have more than one specialist course. However, what is surprising, is that information technology is under-represented compared to these other areas, despite it being one of the more prominent career pathways beyond software engineering. Whilst it is likely currently the case that a general computing education covering networking technology would be sufficient, there is an eclectic mix of skills demanded in IT roles within the industry; for example, combining live events and broadcast management. There was only one course which catered to this dimension (i.e., "Digital Innovation in Sports and eSports"). Additionally, there are few courses which cover the performance and health management aspects of esports. This may be due to the relative infancy of the field, and uncertainty regarding its size. It is also interesting to note that more courses explicitly supported training for professional esports play than presenting at events. This is surprising given the number of content creators in the space.

6.2 Levels of Breadth and Focus

Determining the levels of breadth and focus of each course was difficult with the publicly available information provided by each institution. However, rough estimates were provided to give an overall impression of the foci of each course. A breadth score was calculated based on the count of the different career pathway classifications it received based on the career trajectories and indicative content in promotional materials such as the related

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[4]For reference, the data is available here: https://falmouthac-my. sharepoint.com/:x:/g/personal/michael_scott_falmouth_ac_uk/EdrVH-Ohbh1Bi8AwgrIfjU4BqZQYxxjJCzJZmHF-fnzLzw?e=FXvASN
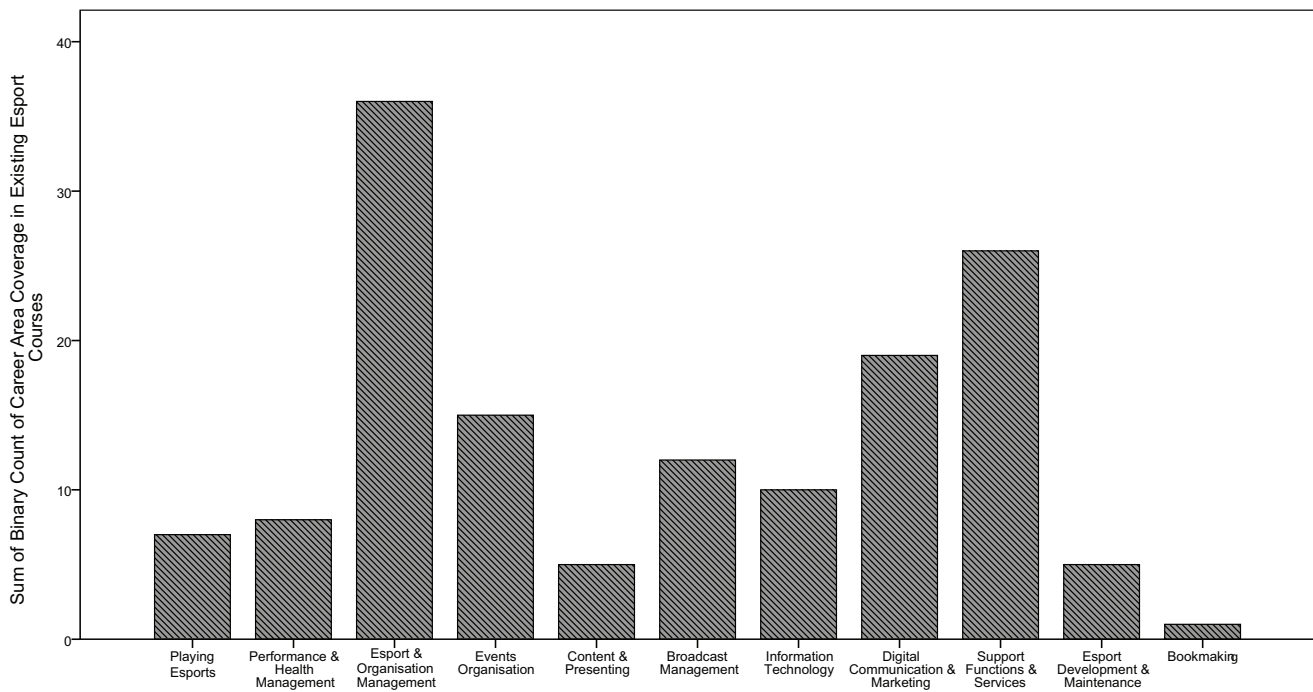
Figure 7: Career Pathways Targeted by Existing Esports Courses in Higher Education
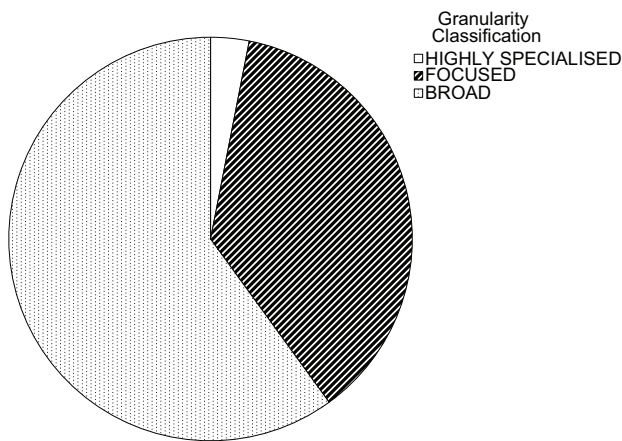

Figure 8: Level of Focus in Existing Esports Courses in Higher Education

prospectus and website. Thus, it received a score of one if it covered only one area, whilst it received a score of twelve if it covered all of the areas in the schema presented in Section 5.1. Each course was then further scrutinised to estimate an intensity value. These were assigned to each course based on the proportion of esports-related content in the course as advertised. Typically values varied between zero and one. These were then combined to calculate an esports focus score. The mean score was 5.004 and the standard deviation was 4.096. These were categorised into 'broad',

'focused', or 'highly specialised' based on a k-means clustering of the ratings (using $k = 3$). The results are shown in Figure 8 which show that most of the courses (60%) are broad, whilst many (37%) are focused, and the remaining (3%) are highly specialised.

Subject focus is important because there will be some students who attended a generic esports programme who might come to feel they were mis-sold on the nature of their degree. Any course that proposes a generic esports course implies coverage and mastery of many different sub-disciplines. However, people working in the esports industry know, professionally, that roles with such a broad remit rarely, if ever, exist. Having an explicit specialism would better reflect a role in industry, provide specific career goals and allow the transferable skills of a specific esports sub-industry to be made more clear than they would be in a generic degree.

7 ESPORTS CURRICULA

Few would argue that curriculum at all levels should be concerned with providing an educational experience by focusing on such things as promotion of independent thinking, respect for self and others, social and political empowerment, acceptance of difference, and ultimately the enrichment of life of every person in our society. Therefore viewing curriculum as solely a syllabus is detrimental to the student and societal development.

Curriculum is concerned with outcomes, and the processes that lead to those outcomes [109]; it is a dynamic process which involves teachers navigating policy frameworks to provide success for individuals [125]. If curriculum is viewed as a product, then there is the tendency for the curriculum to become over-specified, developing into an instrumental box-ticking exercise. The focus on

product as opposed to process, leads to a tendency to follow fads. Curriculum is not a product to be delivered uncritically by practitioners through a 'tick box' approach [109, 110] but rather is concerned with sense making and contextualising practice [75]. Curriculum does not become real until it is enacted in the interactions which take place between the teacher and student [34]. There is an underlying message which is that this requires active engagement by educators. It is not a case of simply carrying out instructions in a 'teacher-proof' curriculum, but rather it is about developing practices to be adopted and about encouraging curriculum as social practice, enabling the concept of curriculum making as opposed to curriculum implementation. The esports curriculum therefore is not just a set of instructions for what educators should do but be considered the resources and ideas which frame action. The knowledge and the skills developed through the curriculum are key, but also of concern is how course conveners assess and evaluate what needs to be built in, so therefore it is also about pedagogy [34, 75, 109, 110, 125].

7.1 General Curricular Considerations

The ACM/IEEE computing curriculum guidelines [2] agree that computing engineering, computer science, cyber security, information systems, information technology and software engineering curricula should, at least on a general level, discuss: social issues and practice; policy and management; information systems management and leadership; project management; user experience design; security issues and principles; systems analysis and design; requirements analysis and specification; data and information management; virtual systems and services; connectivity; parallel and distributed computing; computer networks; integrated systems technology; platform technologies; security technology and implementation; software quality, verification and validation; software modeling and analysis; software design; operating systems; data structures; algorithms and complexity; programming languages and fundamentals; computing system fundamentals; and computing architectures and organization. Given that esports includes many different subject areas in addition to computing, such as production, management, and performance, each with a different set of required skills, the curricular interface with computing (and other disciplines) will be complex. Any framework to support curricula must be sufficiently flexible to accommodate a range of foci and a breadth of potential coverage in terms of knowledge and skills. Sports, as an analogous subject area to esports, has encountered similar challenges from the perspective of specialised curriculum design. As one analogous example which could be used as reference, Seifried *et al.* [122] describes the transformation of a sport management department towards a general business orientation that exists outside of a generic sports department.

Given the industrial focus of esports, and the major consideration of how the degree content transfers to career paths, it is relevant to consider the ways in which the university might collaborate with industry when designing its own curriculum. It has been shown historically that university-industry collaboration results in beneficial exchange of knowledge and helps recruit students [42]. Collaboration between industry and academia can

help expose students to real-world challenges and scenarios and can provide students with the opportunity to utilize their knowledge and problem-solving abilities to address them. One such avenue for fostering collaboration between industry and academia is through undergraduate research projects. Mentors from the esports industry can be recruited to lead the projects. These have been shown to benefit both the students and participating mentors [107].

Another method that can be used to implement industry-academia collaboration is through design competitions [113]. There are a variety of competitions designed to introduce teens and students to computer science [117]. This practice has also been implemented in specialized topics, such as cyber-security [31, 35]. These competitions bring together undergraduate and graduate students from different universities as well as industry professionals to foster collaboration. Competitions may also include career fairs, in which companies may interview student applications for future positions. A similar venue may include focused workshops, which typically include presentations by industry and academic professionals and career fairs. The Grace Hopper celebration [6] is an example of such a yearly event, focusing on research and career interests of women in computing, and introducing students to existing topics and careers in the tech world. Adopting these practices in esports can help expose students to real-world esports career directions and opportunities.

7.2 Subject Area Requirements

Given the degree to which esports has evolved over the last three decades it would also be hasty to make curriculum recommendations without acknowledging the constantly changing nature of esports and adjacent industries such as on-demand broadcast and interactive livestreaming. Any esports curriculum should include a broad overview of the esports ecosystem including, but not limited to, history, careers, production, management, performance, and technology. These topics and areas of esports can be covered in a number of different ways and to varying degrees of depth, but it remains that an esports program should cover each of these areas in broad terms to expose students to multiple areas. Curriculum does not become real until it is enacted in the interactions which take place between the teacher and student [34] and this can be accomplished through introductory courses, which would provide more breadth than depth of the esports ecosystem.

It is also helpful to consider the different layers of curriculum making that take place across the educational system: at the supra-level, it is about ideas from organizations like the OECD; at the macro-level, it is national curriculum; at the meso-level, it typically considerations within an institution; and at the micro-level, in the classroom. It is absolutely vital that esports faculty are making sense of and developing practices, hence emphasis of curriculum making as opposed to curriculum implementation. Equally important are the social practices that take place at different levels of the system as the curriculum is formed as ideas are then translated into action by educators using their professional judgment.

7.2.1 Learning Design. Experiential learning is a critical component in esports curriculum in order to adequately prepare

students for careers in the industry. Theoretical learning is not sufficient for an esports curriculum and should be interwoven with practical experiences. These can occur in a number of experiences and through any number of means, but it remains that experiences are an essential quality to esports curriculum.

7.2.2 Legitimacy. It may be necessary to draw from existing faculty in marketing, business, or communications, who may have little to no background in the topic of esports, but then are asked to apply domain-specific principles onto the topic. That may look insincere or questionable to students who, rightly so, could question if the instructor is actually qualified to teach the course. A major hurdle to have come is trust; establishing legitimacy among students that the degree is valid and that the course has clear links and routes to the esports industry. However, because of the changing nature of the industry and its presently fuzzy borders, it is hard to know how a student or institution might accurately assess how well educator expertise aligns with current industry.

Perceptions of an ideal esports course are likely to form, despite the accurate assessment of any given esports course being challenging given esports' infancy as an educational area. Prospective students will not necessarily be well qualified to understand what makes for an effective course and this may be an issue to consider when designing the curriculum. Branding and marketing of the course is almost as important a consideration as the pedagogic structure underlying the goals for learning outcomes of the course. With esports being a new degree subject, it is difficult to find faculty from a qualified background to teach, research, and develop in this space. It is important to find a mix of instructors from an academic background and from the esports industry to provide the optimal instruction for esports programs. Esports academic faculty that are qualified to teach in this area will largely come from an esports or gaming research background. As more programs are developed and graduates from these programs are produced, there will be a shallow pool of faculty that are qualified to teach in the esports area, so industry experts may be used more frequently until additional qualified faculty populate the space.

7.2.3 Institutional Context & Values. Esports curriculum should be developed as an interdisciplinary area of study in order to mirror the multifaceted esports ecosystem. Esports operates commercially as a business, but there are many other areas of esports that can, and should, be studied in order to fully understand it. These areas include, but are not limited to, business, coaching, kinesiology, media and production, and software engineering. Beyond this, institutions should utilize existing courses at their institution to include in a new esports curriculum to draw on this interdisciplinary approach as well as to draw on the already established strengths of that institution. However, this must be paired with esports-specific modules as well.

An esports curriculum should fit under the mission, vision, and values of the institution and school in which it is situated. An esports curriculum, and program, in higher education must be seen as part of the higher education institution, not a separate program that falls outside its mission or scope. This will have a direct impact on the focus of practicality, research, and professional development within the esports curriculum. An institution that

focuses on research should do the same within an academic esports program, whilst institutions that focus on practical experiences should do the same with their esports academic program. Esports curriculum, like any curriculum at an institution, must align with the mission of the school it is developed.

7.2.4 Credentialing. Esports curriculum, in general, must be held to standards of rigor and relevance through an external review process through certification or accreditation specific to esports or independent steering groups. As more programmes continue to be developed, there is an increasing need for review to ensure quality across institutions. While there is not yet a recognized accreditation or review of esports curriculum, institutions must still be held accountable in order to adequately prepare students for careers and to fulfill educational expectations. A starting point would be to reference existing initiatives which evangelize esports[5][6]. However, these should eventually only complement the external review process, which likely would be performed by esports educational experts. A future body will need to review the outcomes, course work, faculty qualifications, impact, and overall mission of esports academic programs.

7.2.5 Transferability. This same curriculum should provide conceptual knowledge that can also be applied to areas outside of esports. This means it will not constrain students to only be able to work in esports, but also enable them to work across different industries. Lessons learned through the lens of esports should be able to be applied in other areas outside of the esports ecosystem, where cross disciplinary fields overlap. Further, esports curriculum, if designed effectively, will provide opportunities for students to expand their social network and to engage in experiential learning. Students, in order to best position themselves for esports careers, should have a combination of theoretical, class based learning along with a portfolio of experiences.
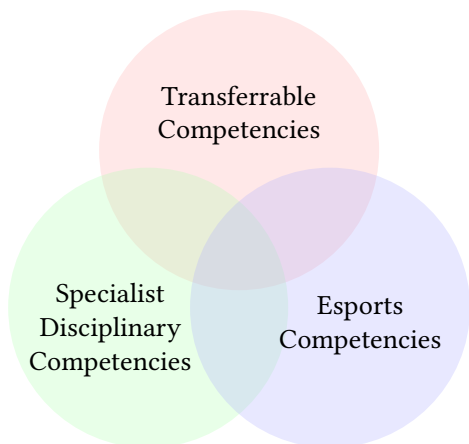
7.3 Assembling the Curricula Framework

A consideration for the framework is the extent to which the curriculum targets a specific sector of the esports industry. Having surveyed the landscape of esports courses in higher education so far and of the myriad of roles and career pathways that industry is seeking, the direction of the field and the challenges it faces are already evident. Particularly, the pathways a curriculum must navigate to confer appropriate depth for a given career whilst also considering breadth of education and opportunity. It will be crucial to help students discover those career trajectories likely of interest to them, as it is possible that students may have an interest in the industry itself without knowing which role they wish to pursue. As such, any recommendations made must acknowledge the different levels of focal specialism within esports. Aside from module and course level aims and learning outcomes, one must also consider the meta-focus of the award in line with the different and potentially multiple disciplines an esports curriculum could teach. One early and outstanding question for the future of esports education is to what extent a broadly generic or a highly specialised curriculum would be ideal.
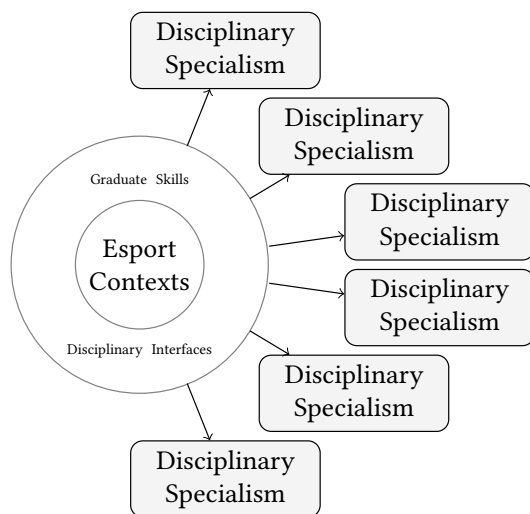
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[5]https://www.varsityesportsfoundation.org/curriculum
[6]https://britishesports.org/esports-and-education/

Figure 9: A Venn-Diagram Illustrating Curricular Dimensions the Working Group Considered

Figure 10: Formation of the Proposed Hub and Spokes Model for the Curricular Framework

In starting to layout the framework, it was seen as serving many specialisms and, as the Venn diagram shown in Figure 9 highlights, overlaps with transferable competencies and esports-specific competencies. This suggests a generic core that distinguishes and contextualises esports and many branches which can extend from this for different areas of focus. Thus, the 'hub and spokes' model shown in Figure 10 is proposed to structure competencies. This model, then, serves as the basis for the curricula framework.

7.4 Hub

Central to the model is a 'hub' of esport context. These are the esports-specific learning outcomes useful to any student of esports, regardless of their career trajectory. The hub of the model consists of core material on *esport contexts*, which largely focuses on the ecosystem of the sector alongside values and ethics. Based on

contextual research to date, the 'hub' should incorporate a core set of *transferrable skills*, including those concerned with *graduateness*. There is also a need to consider *disciplinary interfaces* between the disciplines involved in the esports sector. These provides an outline for the different sub-domains and comprise a set of partially-shared learning where the most overlap exists.

7.4.1 Esport Contexts. With regards to the generic esports competencies and learning outcomes identified, two are important: 'esports ecosystem' and 'esports values and ethics'. Any student studying esports regardless of specialism will need to develop commercial awareness, understanding the esports ecosystem and how the different forms of business operate and interact. They would also need to develop an awareness of ethics and the socio-cultural values that inform esports. This is important because if a student is entering into the industry, then they must have an awareness of what esports is, what it means to the different parties involved in esports, how it has developed historically, whilst also critically analysing the circumstances, parties, and contexts it now and will exist within.

The most unique skill-set to a career in esports relates to the playing of esports at a high level which is somewhat distinct from some of the skills required by a professional athlete and are obviously game dependent. However, the curricula recommendations mentioned here have discounted the idea that a student would pursue a career playing esports through higher education specifically. The playing of esports is not something one would begin their career through by approaching formal channels such as a job advertising site or higher education programme since esports athletes tend to benefit from engagement with a game from a young age. Furthermore, there is an early retirement age amongst esports athletes [103, 129]. They would likely have already chosen, and be best suited, to pursue a career as a professional player before reaching higher education. Indeed, many may only pursue competitive play in the context of higher education as an extracurricular activity. Thus, the hub does not include competencies relating to the play of esports. Though, engaging with esports in a meaningful way could be considered as a means of developing transferable skills.

7.4.2 Graduate Skills. Educators often label these as "21st century skills" [114], though here they are labelled "graduate skills". They are those skills which are considered necessary for securing, maintaining, and enhancing performance in careers [92, 112]. These skills are often foundational, generic, and transfer to a wide range of domains. Examples include information processing, critical thinking, problem solving, management, and metacognition skills [30] as well as many others corresponding to working life, which may include:

- Professionalism
- Communication
- Organisation and Management
- General Analysis
- Reflection
- Research
- Collaboration

Almost all esports careers benefit from transferable competencies. Communication, organisation, and collaboration are naturally needed for effective team working, especially in interdisciplinary contexts which make up the bulk of a lot of esports practice where individuals may have skills that cross several disciplines or need to work with many others in different disciplines. When looking at the different contexts that exist within esports, broadcasters, community managers, data analysts, events managers, coaches and marketing personnel will all need to be able to work with other people and departments to collectively deliver events, broadcasts, a good standard of performance from players, and to foster positive engagement with audiences. Research, reflection, and general analytical skills would be at the cornerstone of any university curriculum that encourages its students to be able to find, synthesise, and share information as well as critically reflect on the world around them as well as their own continuing development. This is just as true for esports and, again, the practical contexts in which esports exists would serve to develop the skills through practice-based assignments and help to consider the changing nature of esports in terms of the new technologies that become available over time as well as the different games and communities that could exist. Lastly, a sense of professionalism, or what might be termed 'graduateness', is a key competency that should be assessed to help ensure resilience in the graduate given the emerging nature of the esports industry and the careers it offers. These competencies are important to incorporate into a curriculum and to embed in delivery because any degree-level qualification should facilitate graduates in pursuing a wide range of career trajectories beyond those for which the course is specialised as not all graduates will choose to remain in esports as their career develops.

7.4.3 Disciplinary Interface. There would also need to be some form of disciplinary interface. This is due to the multidisciplinary nature of esports and the complex way in which 'spokes' could branch from the 'hub' and interact with each other. The careers, skills and subjects that esports captures are quite diverse and do not always neatly overlap. For example, the skills to become an esports presenter are different to those required of an esports community manager, an esports showrunner, or an esports data analyst. However, all of these roles will contend with communication and collaboration skills, and face operational challenges together. Similarly, they will all benefit from generic esports learning outcomes such as an appreciation of the context of the esports ecosystem. Part of the difficulty in proposing recommendations for an esports curriculum is that the word esports as an umbrella term is not always clear-cut in practice, or more accurately may not yet be clear-cut. Esports careers still occasionally overlap with domains such as game development, which in most cases only has a tangential connection to esports, and yet it also does not always formally overlap with relevant domains such as coaching and health.

7.5 Spokes

Branching out from the center of the model are the 'spokes'. These are disciplinary specialisms emerging from the esports sector. This is based on the acknowledgement that a single holistic curriculum will not adequately serve every single specialist career identified within esports so far. A more likely goal will be to recommend that any given curriculum be tailored to the specific specialist focus of the educators. These learning outcomes can then be organised around various modules that best fit the course design. Key areas of disciplinary specialism include:

- Data Analysis
- Content Creation and Streaming
- Coding and Technological Competency
- Performance, Health and Well-Being Promotion
- Marketing and Branding
- Community Management
- Events Management and Planning

Of the specific esports competencies proposed here, none of them are absolutely unique to the field of esports. They are shared by a range of specialist vocations. For example: data analysis relates to data science; content creation and streaming relate to media production; marketing, branding, and community engagement relate to public relations generally; leagues and tournaments relate to events management; performance, health and well-being promotion relate to sports science and psychology; and so on. However, there is rationale for each of the specialist disciplinary competencies in the spoke due to their alignment with the career opportunities identified by the working group members.

7.5.1 Data Analysis. One of the clearest use cases in the development and maintenance of esports and esports streams is the need to analyse data for a variety of purposes. Match analysis, consumer engagement, user behaviour tracking, better understanding the changing 'metagame' for the sake of game balance, as well as potentially automating feedback for the purpose of coaching (both for professional and nonprofessional consumers of the game). Esports provides a lot of data that is valuable to many parties and data analysis is an extremely useful competency in this domain.

7.5.2 Content Creation and Streaming. Esports constitutes a large media landscape which requires careers that can help facilitate the production, mediation, and dissemination of esports, typically through live streaming. As such, this set of competencies is related to the production and dissemination of esports media whether that's live play, commentary and analysis of that play, or related ancillary content made available typically in an online context. This set of competencies would not only consider the media literacy and production skills required to create the content, but also the technical skill to make that content available in live and recorded forms. There is scope for this competency to include innovation in the way in which information is provided to the viewing audience as well as how the audience is engaged through the platforms being used.

The skills of presenting esports in the manner of shoutcasting or commentating may come under this competency, but it should be noted that the career for this specific role features relatively few job adverts in the actual job market. Furthermore the routes to it are usually taken by those already embedded within an esports community prior to any intervention by higher education. Our career analysis showed that there were almost no job adverts for

the specific role which is most likely a symptom of informal hiring through community channels than due to lesser demand for this kind of role within industry.

7.5.3 Coding and Technological Competency. Many esport careers showed a need for technological support, maintenance, and additional software that might help the organisation, broadcast, and tracking of a given esport. This included development and setup of infrastructure for streaming. A considerable number of the roles in the space involve the maintenance of existing esports, however the label 'esport' is only achieved by a game in accordance with its community. So, one is unlikely to develop an esport 'from scratch'. Therefore, roles and competencies in this area would not be in innovative game development but in maintenance, support, and secondary software that support esports e.g. artificial intelligence to aid coaching.

7.5.4 Performance, Health, and Well-Being Promotion. Although the careers analysis identified very few active job adverts in this space, the need for maintaining the mental and physical well-being of esports athletes (and nonprofessional esports players) is comparable to that of any other sport given its relative size. Thus this specialist disciplinary area should relate to the assessment of how health and well-being are tracked and potentially linking this to specific strategisation by coaches and teams.

7.5.5 Marketing and Branding. Another prominent career classification was digital communications and marketing. Conveying information about events such as tournaments so that a regular audience is guaranteed and informed is crucial to the success of many esports events. Branding and marketing opportunities exist both within esports audiences in terms of event and tournament promotion but also through collaboration with endemic and non-endemic brands for sponsorship and advertising opportunities to generate revenue.

7.5.6 Community Management. This competency touches upon the need for managing a community (the bedrock of any esport) either directly as a contractor to an esports publisher or on the behalf of a prominent esports brand such as a well-known tournament or product (e.g., esports peripherals).

7.5.7 Event Planning and Management. Event planning and management is necessary in cases where a physical or digital space must be constructed and organised for the smooth running of an esports event. Although esports are obviously not the only context in which events management is useful it does form a major subdomain for the subject that would be worth considering for a higher education curriculum given the number of industry positions and relevance of the subject.

7.5.8 Other Competencies. Other career pathways are present in the esports sector, but their nature or specialisation is uncertain or inappropriate. Consider, for example, bookmaking, which would appear to constitute a major growth area within esports [58, 99, 149]. However, suggesting ways in which a higher education course might approach bookmaking for esports is difficult outside of the frame of legal regulation. Those looking for careers in bookmaking for esports would likely benefit from looking at the same for sports more generally. The presence of bookmaking or gambling related

courses in higher education is not without precedent and even the survey of existing esports courses picked up on some steps in this direction. However, it would be somewhat unusual to recommend a morally and legally grey zone as a site for competencies. Instead, it could be a context for critical reflection, or be a possible specialist focus for students doing a mathematics or statistics degree.

7.6 Curricular Integration

As a note, the working group identified that liberal arts style programmes that make use of a major and minor system might be well suited as they allow flexibility. Furthermore, esports competencies do not need to be part of a general esports curriculum but could be electives in more general degrees, such as esports technology under general computer science. Thus, this working group endorses two potential approaches, one that uses the hub and spokes model, and another that uses only the hub:

(1) A curriculum with a common spine, made up of transferable and esports generic competencies, that further specialises into a specific disciplinary competency;
(2) Take an existing major degree in a non-esports subject and add elements of common spine using the esports hub. For example, esports would exist as a minor subject within a major degree such as events management or health and performance management.

8 CONCLUSION

In conclusion, this working group illustrates a notion of esports, laying the foundations for a framework that will support the design of esports curricula at higher education institutions. A broad background on esports is provided for the unfamiliar reader, alongside further context that may help readers to understand the wider societal implications presented by esports. An analysis of esports careers is then presented, illustrating several career pathways with demand from the esports industry. The report then concludes with insight into esports education and some considerations for the design of curriculum. This will help pre-service and in-service teachers, curriculum developers, university administrators, and academics in coming to understand the potential role of esports in higher education; particularly, those university departments which are wading into the realm of esports for the first time.

Esports is a unique domain, not a unique discipline. Much of the framework proposed by the working group and the analyses its members conducted became focused on untangling exactly what constitutes the esports industry and esports itself as a subject area. While it is clear that esports is growing and the demand for esports-related higher education opportunities is increasing, it is less clear how the domain of esports can be neatly subdivided into different specialist areas. Although there are many people increasingly working in the field of esports these disciplines are scattered across the different subdomains of esports with a highly varying degree of overlap. However, the core themes that emerged from discussions between members of the working group formed recommendations, listed as follows:

- Consider the broader context of the esports ecosystem including, but not limited to, history, careers, production, management, performance, community, and technology;
- Interdisciplinarity is core to the decision to focus on one or another specialism within esports - one must 'pick a lane' to align with esports career opportunities and avoid the drawbacks of a more generic focus;
- Consider the mission, strengths, and available resources of an institution and how this might align with the particular specialist option that esports is being presented alongside;
- Avoid positioning the playing of esports as an exclusive or majority focus;
- Student expectations of the scope of a given esports curriculum in terms of the diversity of skills and the level of granularity offered must be managed through careful branding and marketing;
- Esports is primarily a practice-based subject and as such must rely on experiential learning;
- Philosophy and values must be rhetorically embedded in the curriculum to reflect the ethical and moral challenges facing esports currently, as well as consideration for the specific cultural context that informs attitudes towards esports, and in which the curriculum operates.
- The mission of the educator's institution should be considered;
- Graduateness must be built into the curriculum to better ensure the curriculum meets the demands of a changing and diverse industry;
- In the current absence of a regulatory accreditation body to hold curricula accountable to quality and rigor, esports curricula should consult with appropriate representatives from industry and academia for steer on curriculum design and content;
- There is some scope for research into the extracurricular benefits of esports as an activity alongside higher education as well as the benefits that may exist for developing transferable skills.

In closing, though they are only foundations at present, the work presented in this report and these recommendations will hopefully stimulate a continuing discourse on what an esports curriculum in higher education should include. Such discourse will ensure resilience in the study of esports as a whole. Though the question this working group set out to address implies a prescriptive set of recommendations as its eventual answer, with the considerations made in this report, the group is not proposing a one-size-fits-all answer to esports curricula. This minimises the risk of potentially excluding relevant esports subject areas that are currently small or still emerging. There is not a one-size-fits all answer to what an esports curriculum should, or could, cover. Esports is a domain that is still growing and changing and this must be borne in mind when formulating a curriculum. Each program will have its own nuances and be different according to a number of factors, such as faculty, institutional mission and vision, and other academic programs offered. It is instead the hope that this report provides insight into the broad characteristics that would make an esports academic program relevant and beneficial.

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