Learning from Ludemes: An Inventory of Common Player Actions within Tabletop Role-Playing Games (TTRPGs) to Inform Principled Design of Game-Based Learning Experiences

Abstract: In this study, the authors investigate role-playing game design through the lens of instructional design practice to probe the ecosystem of tabletop role-playing games (TTRPGs) and their applied use for learning. A qualitative thematic analysis approach is used to systematically catalog and categorize all possible player actions, called ludemes, from the 5th Edition of Dungeons & Dragons (*D&D*). Through this analysis, the interplay of game mechanics, player actions, and rules of TTRPGs are explored, unveiling their potential to stimulate various psychological, environmental, and behavioral factors that positively influence learning processes. Specifically, this study's analysis of a game's ludemes (i.e., player actions) exposes the interrelationships, congruence, and combinations of actions with various learning processes. The identified categories of ludemes in the study pave the way toward a working vocabulary and framework for future research in the application of game-based learning and its potential to catalyze meaningful learning outcomes. From a global instructional standpoint, this study highlights the role of pedagogical affordances, such as collaborative storytelling and problem solving skills, theorizing how TTRPGs can promote cognitive, metacognitive, affective, social, and cultural learning. Toward these goals, the authors posit that role-playing, with its complex dynamics and compelling narratives, offers a robust and natural conduit for learning.

Keywords: ludemes, *Dungeons & Dragons*, tabletop role-playing games, learning, education, pedagogy

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1. INTRODUCTION

While active learning strategies have repeatedly outperformed more traditional strategies, such as rote memorization, effective incorporation into formal education remains challenging for educators (Hake 1998; Prince 2004; Freeman et al. 2014). One promising strategy for driving active learning into formal learning environments is game-based learning (GBL; Plass, Mayer, and Homer 2020), particularly within the context of tabletop role-playing games (TTRPGs). The term "role-playing game" (RPG), in general, encompasses game types that are characterized by players portraying and developing characters in an imagined setting, governed by sets of rules (Arenas, Viduani, and Araujo 2022). TTRPGs are a type of RPG that can be thought of more specifically as collaborative participatory narratives in which players adopt the personas of characters within imagined settings and are guided by a game master (GM) who orchestrates the narrative and facilitates the game mechanics (Bowman 2010; Abbott, Stauss, and Burnett 2022).

Although the generative narrative among players in a TTRPG can be supported by summary sheets, books, and digital tools, the game itself is not automatically narrated or scripted. Instead, it is crafted by the players only during the act of playing together. The dynamic and emergent experiences offered by TTRPGs promote learner engagement and facilitate collaborative learning (Barron 2003; Zagal et al. 2006; Anderson and Dron 2011; Bowman 2010; Nicholson 2015). In TTRPGs, the game's continuity is driven by both the players and the GM, with the GM taking on the major role of facilitating or "holding together" the game world and narrative and serving as referee to the players in order to maintain narrative cohesion. Drawing from the principles of experiential learning, education researchers increasingly understand that a person's actions, including tasks and engagements within an RPG experience, are pivotal drivers of their learning process (Wenger 1999).

The learning potential of role-playing games may be just as powerful as their entertainment value due to their immersive, interactive, and inherently social nature. They provide a unique setting where players can engage in simulation, which is a critical aspect of experiential learning. Experiential learning theory, as proposed by David Kolb (1984), suggests that knowledge construction occurs through a four-stage cycle that includes concrete experiences, reflective observation, abstract conceptualization, and active experimentation (Kolb 1984). Immersive simulations, such as those found in RPGs, provide opportunities for all stages of this learning cycle. Further, research indicates that immersive simulations can enhance motivation, engagement, and deep learning (Dede 2009). This is because they provide authentic, complex problem-solving scenarios that closely mirror real-world contexts, thereby increasing the relevance and applicability of the learning.

The simulated game world in RPGs often functions as a "safe space" where players can experiment with different identities, strategies, and scenarios without the fear of real-world consequences (Gee 2003). This feature allows for experimentation within worlds and rehearsal of complex situations, providing a high level of authenticity and situated cognition (Brown, Collins, and Duguid 1989). According to situated cognition theories, learning happens most effectively when it is associated with social and physical contexts that reflect how that knowledge will be used in real-life situations (Lave and Wenger 1991). While some aspects of the fantasy worlds of RPGs are outside the realm of reality, there are a number of elements that can mimic real-world systems, such as economics, politics, or ecology.

Problem-solving scenarios native to RPGs often involve decision-making tasks that allow advanced players to model expert processes. Some examples might include players who need to strategize like a military commander, negotiate like a diplomat, or solve puzzles like a detective. This kind of expert-level modeling can potentially facilitate the transfer of learning to new contexts (Bransford, Brown, and Cocking 2000), and may allow more novice players to learn through observation. RPG worlds and characters can reflect diverse cultures and social systems, which provides opportunities for players to gain empathy and understanding of different perspectives (Nicholson 2015). Moreover, players typically work together to overcome challenges, fostering valuable social skills that may also be transferred to real-world contexts (Steinkuehler 2006).

However, despite the increasingly evident potential of role-playing games and their continuous evolution through creative innovations by both mainstream and indie developers, a significant gap exists in understanding the design principles that contribute to the mechanisms behind effective learning through role-playing. Game designers with an eye toward learning are tasked with creating engaging learning experiences by assembling a combination of activities within a game that stimulate beneficial learning processes and outcomes. Nevertheless, in the context of role-playing design, whether specifically geared towards learning or not, creators do not currently have a comprehensive inventory of player actions and the expected learning outcomes these actions could generate.

In this paper, we take an instructional design perspective toward formally analyzing tabletop role-playing games (TTRPGs) for what people *do* in role-playing games and how these actions translate into learning outcomes. To accomplish this goal, the authors present a method for formally identifying common player actions, or *ludemes*, in *Dungeons & Dragons 5th Edition*, an example case of TTRPGs in which players collaboratively develop narrative as a result of gameplay. As learning is inherently a participatory process that requires actions on the part of the learner, the identification and categorization of actions that players can take within the context of the game rules is an important tool for employing player actions in games that have the intended educational impact. Using a qualitative thematic approach to analyze the game's official rules, 37 unique categories of player actions called *ludemes* are categorized and aligned to the potential learning processes that can be activated as a result of players taking various actions within the game. In addition to the identification of a taxonomy of ludemes that are common to TTRPG play, another implication of this study includes the presentation of

design principles for TTRPG developers and educators toward maximizing learning opportunities via TTRPGs and larps, as role-playing is a robust, natural, and fun way to learn.

2. BACKGROUND

2.1 Real Learning by Playing Pretend: Applied Role-Playing Games for Learning

Role-playing games, whether tabletop, live-action, or computer-based, have been used across various industries, from medical fields such as nursing, surgery, and dentistry, to international relations and history education. The power of RPGs in promoting learning emerges from their immersive, player-driven nature and the multitude of learning affordances they offer.

RPGs have been regularly shown to stimulate cognitive processes such as strategic thinking, problem-solving, and decision-making (Gee 2003). Moreover, RPGs foster metacognitive growth by encouraging players to reflect on their and others' decision-making processes to enhance their gameplay (Zimmerman 2002). From an affective perspective, RPGs evoke a wide range of emotions, contributing to overall player engagement and motivation (Ryan et al. 2006), as well as a sense of agency and sense of belonging concerning the player's characters and investment into the game (Bowman and Schrier 2024). Adding to the affective affordances of RPGs is that they are inherently social, requiring collaboration, communication, and negotiation between players (Vasalou et al. 2008; Woods 2016). These social affordances can be examined by treating the game as a social network, where each player and their decisions are considered or analyzed based on their effect on the overall gameplay and player experience. On the social affordances spectrum, narrative components, which are critical elements in RPGs, allow players to feed their natural affinity for learning through stories and sequences of events involving interactions between characters (Bruner 1991; Schank 1990; Koster 2005). TTRPGs stand out among various game types in the way they offer unique opportunities to foster emergent narratives, and to simulate complex systems with remarkable detail. They also excel in the use of storytelling to model fascinating game worlds, and allow the collaborative shaping of events within a well-defined set of rules and player interactions. The fun and novelty in these experiences add to the engagement, bolstering the relationship between learning and games (Koster 2005).

Regarding pedagogical benefits, RPGs can be designed to target specific learning outcomes (Hammer et al. 2024). The relationship between player actions, game mechanics, and learning outcomes in a game can be formally studied and optimized to enhance the game's educational value (Klopfer et al. 2009). RPGs also offer culturally relevant pedagogical exploration opportunities, providing a platform for understanding diverse cultures, histories, and perspectives (Squire 2008). In addition to the pedagogical benefits derived from RPGs, there are powerful affordances for broader, global learning outcomes. These games offer a rich, dynamic environment that simulates real-world contexts and simplifies them, reducing complexity while maintaining relevance. This parallel between the game world and the real world provides a foundation for understanding and interacting with the complexities of reality in a safe, manageable environment. Inherent in RPGs, simulation is instrumental in modeling real-world phenomena, especially in the context of socially embedded phenomena and emotional responses (Aldritch 2005; Gee 2005; Barab et al. 2010).

Role-play, a fundamental aspect of RPGs, is a natural way for learners of all ages to make sense of their observations, integrate new information, and test out ideas in a safe, rule-defined environment (Garris et al. 2002; Thibodeau et al. 2016). These simulated real-world actions are key for both conventional educational paradigms and experiential learning designs, mirroring scenario-based, case-based, problem-based, and project-based learning. RPGs offer low-risk environments that are entertaining, engaging, and relevant, providing opportunities for both synchronous and asynchronous

play (Hammer et al. 2024). The strong simulation component of RPGs represents a wide range of potential character actions within the game world, setting the stage for a unique phenomenon of triple-layered interaction. This layered phenomenon involves a first layer of participating as a player that strategizes within the game and a second layer of acting as a character within the game world and staying within character. This is complemented further by a third layer, a meta-level of experiencing which goes beyond the primary table roles in the game. These immersive qualities embedded in RPGs are central to their transformative nature, suggesting deep learning potential (Fine 1983; Bowman 2010; Bowman and Schrier 2024).

In the world of RPGs, the distinction between player actions and character actions is vital. Character actions are bound only by players' imaginations within the scope of the game world and rules, and are effectively simulated actions performed by characters in a fantasy or fictional setting. Although they are representing fictional characters, players' in-game actions can also mirror the cognitive strategies, skills, and knowledge that can be used in the real world (Clark and Martinez-Garza 2012). With this in mind, it is important to recognize that the power of learning is derived from both realms. The ability of an RPG to simulate physical and social processes combined with the application of narrative to create engaging game worlds facilitates opportunities for co-constructing simulated, but effective sequences for developing understanding within a well-defined rule system (Gredler 1996). The game's rules system constrains the game, making it manageable while allowing for emergent gameplay that promotes active learning.

Despite the increasing popularity of RPGs and their recognized potential for learning, there is a gap in design principles targeting the optimization of these games for learning outcomes and processes for simulating real-world knowledge, skills, and cognitive tasks within games. This study addresses this gap by taking an instructional design perspective, analyzing players' actions in RPGs and their translation into learning outcomes. This approach aims to develop a comprehensive inventory of RPG mechanics and principles to enhance learning, providing a foundation for designing RPGs with learning outcomes in mind.

In conclusion, role-playing games, particularly TTRPGs, offer a unique and potent blend of learning affordances. The combination of narrative, simulation, social interaction, and active engagement in a rule-defined yet imaginative world offers unprecedented learning opportunities. Both a challenge and goal moving forward are to harness these affordances effectively, optimizing the design of RPGs to maximize their potential as powerful tools for learning.

2.2 Understanding Learning through Gameplay with the Social Cognitive Theory Lens

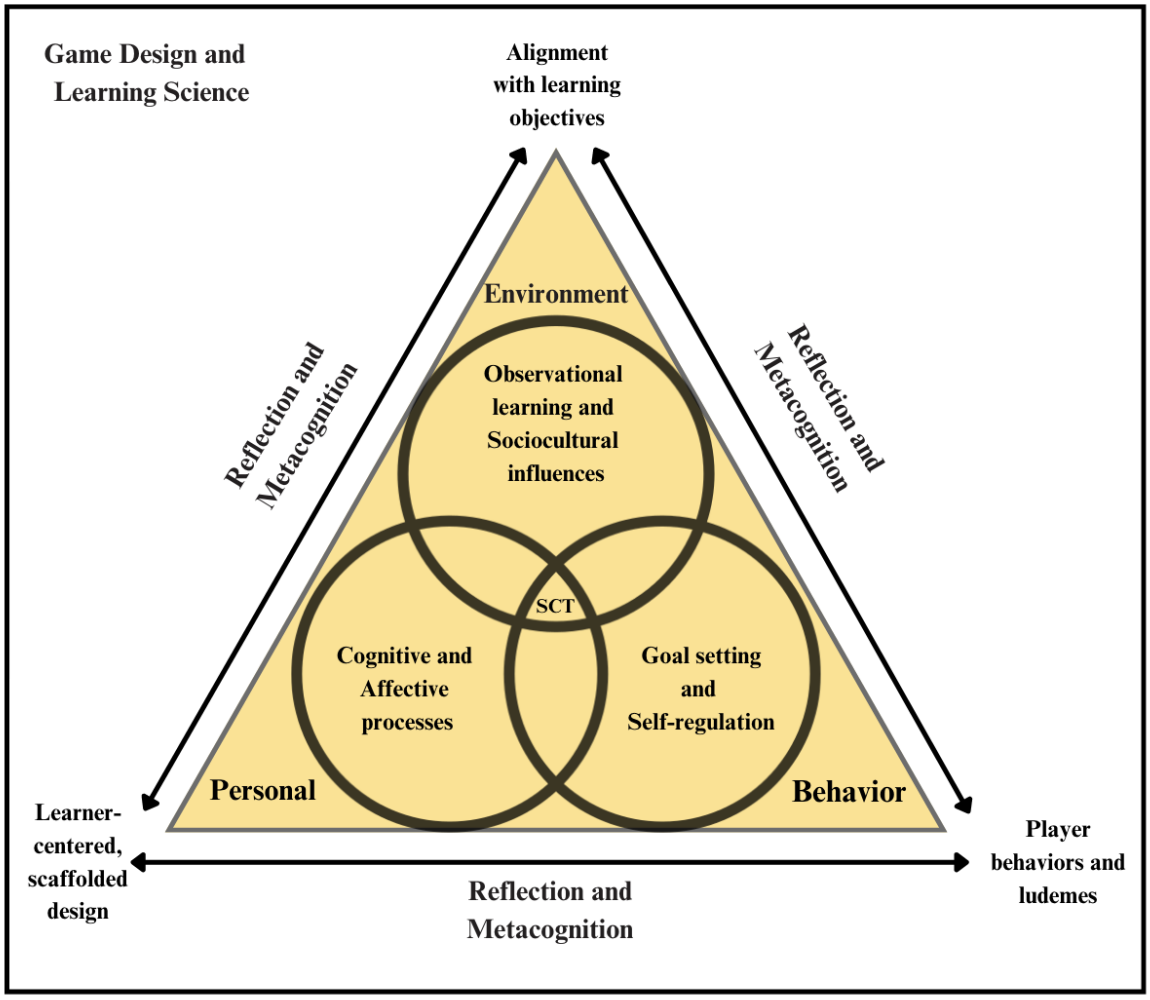
Social Cognitive Theory (Bandura 1986) is a psychological framework that seeks to explain human behavior, learning, and motivation as a complex set of factors that mutually influence each other. The theory incorporates elements from both constructivist and sociocultural perspectives on learning to predict changes in individual learning and behavior by considering the dynamic, reciprocal interaction between the person, environment, and behavior within a social context. This interaction is viewed as being both influenced by and simultaneously influencing individual learning and behavior.

SCT provides an excellent lens for considering the links between TTRPG gameplay and learning, as it explains the mutual influences of factors on changes to the individual within rich social settings. Depicted in Figure 1 is a modified version of Bandura's (1986) triadic reciprocal determinism model. In this model, a dynamic and reciprocal interaction exists between an individual's personal factors (cognition, affect, biology), their environment, and their behavior. These three factors continuously influence one another, shaping a person's learning and development. The model also reveals the level of complexity involved in designing and carrying out research to test the effectiveness of any learning experience, such as using TTRPGs as learning tools.

Within a designed learning experience like a game, SCT highlights the importance of setting personal goals, engaging in self-regulation, and experiencing a high degree of agency over one's own learning to achieve desired outcomes. Self-regulation involves self-monitoring, self-evaluation, and self-reinforcement, allowing individuals to adjust their behavior and strategies to meet their goals. SCT also maintains that an individual's cognitive and affective processes play a critical role in determining behavior. These processes include knowledge, attention, memory, motivation, and emotional regulation, which interact with the environmental and behavioral factors to influence learning.

Directly paralleling the capabilities of TTRPGs, SCT emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others within social settings (including experts). This includes simulated social settings like TTRPGs and other simulation games. According to SCT, individuals can learn new behaviors and acquire new information by watching others (i.e., models) perform those behaviors. SCT also emphasizes the broader role of social and cultural factors in shaping individual behavior and learning. Social norms, cultural values, and expectations can impact an individual's cognitive processes, motivation, and self-efficacy as much or more than observational learning.

Figure 1. The Social Cognitive Theory (SCT) Framework



Within an SCT perspective, learning is any demonstrable change in behavior, knowledge, or affect. The operative mechanism for promoting learning is *activity* or *participation* by the individual within the learning experience (Wenger 1999). In other words, human learning can be facilitated by

doing something, in which the activity to be performed is influenced by someone's prior knowledge, affect, and the environment. Even if a learner is simply observing others or consuming media, these are still actions that they are performing within the learning setting. Specifically, learning requires continuous engagement in socially mediated experiences. This involves participating in activities, internalizing new information, and then applying this knowledge in subsequent actions. The key driver of learning is the act of *participation*: without some form of action from the learner, the learner does not encounter new information nor attempt a change in behavior. In other words, in any situation, learning does not just happen by itself, or information is not simply transferred. Instead, learners must have experiences in which they are active participants (Kolb 1984).

Also within this perspective, the outcome of learning is inextricably tied to active participation in the learning activity. This theoretical principle carries over to TTRPGs that are designed with learning goals in mind. In TTRPGs for learning, participation in the game is the primary mechanism at which learning happens: the game prompts a player to begin their journey or to continue their quest -- a TTRPG cannot play itself. An expectation of participation via player action influences and is influenced by the other factors in the SCT framework, including the social setting, a person's knowledge and attitudes toward participation and learning, the structure of the game, and the context in which the game is played for learning (such as school or work).

2.3 SDT and Motivational Aspects of Gameplay

In addition to SCT, other complementary learning theories can help designers make sense of learning interactions within games. Self-determination theory (SDT), developed by Deci and Ryan (1985), prioritizes three motivational needs (competence, autonomy, and relatedness) behind people when they are making decisions. Based on these three needs, role-playing games may be a powerful tool that can be used to leverage the power of intrinsic motivation in learning scenarios. Competence in content learned from TTRPGs may then be better achieved through players overcoming challenges and engaging in strategic collaborative problem-solving within the game's narrative, enhancing their sense of efficacy and self-concept. Autonomy can additionally be thought of as a built-in feature of this genre, as TTRPGs offer significant narrative choices that impact the game's direction, empowering players with control over their actions and the game itself. Lastly, the concept of relatedness may be tied to the collaborative nature of RPGs, where players, or party members, work together towards common goals and ideally form a strong sense of belonging within the game's social structure.

The idea behind the potential link between role-playing within TTRPGs and the activation of intrinsic motivation stems from the degree of inherent satisfaction derived from the activity itself (role-playing) rather than external rewards. While intrinsic motivation may act as a mediator in achieving learning goals, RPGs also incorporate extrinsic elements such as rewards and achievements for characters that may impact these goals. In the end, the reward structure that is or is not effective in helping students achieve learning goals depends on the individual student.

As part of the conversation about SDT and motivation, it is also important to mention the related concept of *demotivation*, which can arise when the intrinsic needs of competence, autonomy, and relatedness are blocked or otherwise not present. In a game-playing context, overly controlling environments, the lack of engaging content, and insufficient support for social interaction may lead to decreased engagement for some students and hinder the learning process. The way in which TTRPGs might be used for independent exploration and narrative development based on players interests is therefore highly relevant to formal education settings. Allowing the game to unfold in unpredictable, but monitored ways is important for achieving maximum learning potential.

In any designed learning environment, instructional designers seek to facilitate the desired changes in behavior with which learners can demonstrate new knowledge and skills, and perhaps even

changes in attitudes and the learning environment. TTRPGs can therefore potentially activate many of these learning possibilities by creating a malleable game environment that is constructed socially by the players in response to the players' interests, goals, and learning. Rules for player engagement and action exist within TTRPGs but are flexible toward transformative play for the learner. TTRPGs can model with a high degree of fidelity multiple domains for learning, allowing for exposure to content, skills, and expertise simulation that are authentic toward the real-world originals. However, participation is nonetheless required for gameplay to continue as a TTRPG cannot play itself, and participation types and skill is expected to change and grow as a result of continued play.

2.4 Prioritizing Player Actions: The *Ludeme* as a Unit of Participation in Games

Designers of RPGs often intend for a variety of player actions or "moves" to build the foundation of the mechanics that drive gameplay. These actions are essentially the decisions made by players that affect the course of the game and co-create the game experience. They symbolize player autonomy and active participation, which are valuable components of the learning process. In this context, the concept of learning is participatory, extending even to observational activities, such as choosing to be present and staying attentive.

Understanding the concept of participation and action as they apply to game settings evokes a look into the rules of games, which govern both the game mechanics and player actions. From an instructional designer's perspective seeking to improve player participation in learning, it becomes necessary to differentiate between these two terms of *game mechanics* and *player actions*. The works of Mariais et al. (2010) and Montola (2008) provide some distinctions between these terms. First, game mechanics are the processes that are embedded within the game rules that dictate how the game is played, such as the game structure, pieces, equipment, logic, and automated processes that must be done for the game to progress. Player actions, on the other hand, are the discrete points of engagement that players have with the game, which are often known as "moves," "turns," "strategies," "tactics," or, as we use in this paper, "ludemes." Mariais et al. (2010) argue that the breadth and depth of embedded game mechanics directly influences player engagement and learning outcomes, while Montola (2008) emphasizes the emergent nature of player actions, suggesting that the depth of the learning experience in TTRPGs is significantly shaped by the players' choices within the game's narrative and rule constraints. From the standpoint of prioritizing participation in learning-intended games, the term "ludeme" in relation to player action is especially significant, as it serves as an analyzable unit of participation in games.

A *ludeme* is the basic, fundamental unit of play in a game that a player can perform (Parlett n.d.; Stephenson et al. 2021). A game cannot exist without ludemes, just as much as it cannot exist without its mechanics, dynamics, components, and underlying logic, structure, and rules. Ludemes represent the individual interactions that players perform within a game environment, much like learners' actions do in a dedicated learning environment. If the parallels are followed, this further cements the idea that gameplay and learning are, first and foremost, participatory activities. In social settings, these interactions can be observed, refined, and understood, facilitating participants' co-creation of knowledge and understanding. According to Parlett, a particularly valuable characteristic of the ludeme is that as a discrete unit of player action, it can typically propagate from old games into new games in similar ways, much like a *meme* is shared across social media, making player actions directly comparable between games.

In game-based learning contexts, this is valuable for generating comparable evidence of participation across game contexts and the subsequent testing of the effects of different ludemes (i.e., player-learner participation patterns) on achieving learning outcomes. Reusable ludemes, such as *moving,*

capturing, reaching the finish, attacking, defending, upgrading, and *collaborating* often appear within game heuristic systems that commonly appear across games and genres, likewise recycling common types of actions or moves that players can take within games and increasing familiarity for the player. Such heuristics can explain how many games retain similar player actions or looks, despite being designed for separate purposes, themes, or content (Elias, Garfield, and Gutschera 2020; Engelstein and Shalev 2022).

In a learning context, game action heuristics that players know have commonalities with activities associated with learning. In similar ways to playing familiar games, learners typically take repeated actions to learn content and skills in classroom settings, or they make similar "moves" while learning new content. To harness the potential of RPGs as learning tools, it is crucial to understand the variety of player actions and heuristics that learners hold as they relate to the design and study of learning within these games. This invariably involves "looking under the hood" of a game's design to identify both its mechanics and the actions that players take to identify their similarity to the actions that people take in learning environments. By focusing on concretely defining, applying, and testing the game features that drive player engagement and learning, designers can create more effective and engaging RPG experiences.

With this goal in mind, analyzing games at a *ludemic* level (i.e., by identifying and investigating each *ludeme*) can reveal patterns of observable player behavior linked to learning outcomes. From an educational theory perspective, participation in a game can be evidence of learning through demonstrated mastery of the game's activities and completing the experience. However, participation also represents the learning process in that every new experience a person has invoked learning. The more a person participates in a game, the more that their participation allows for changes in their behavior to occur through practice and for mastery to be gained. Investigating a game at the ludemic level allows capturing individual player actions. This gives researchers the ability to track and identify the changes occurring in a person's observed behaviors in how they play the game by using knowledge and skills, and thus, is evidence of their learning.

2.5 Without a Table to Roll On: Toward an Inventory of Ludemes in TTRPGs for Learning

In the previous sections, we held that participation is the primary mechanism by which learning occurs in any designed learning environment, including game-based learning. In consideration of participation, a game typically will not play itself without interaction from players, and thus would not affect learning if there is no participation. Therefore, we approach how *role-playing* games can promote learning from an instructional design perspective based on players' participation.

However, the current research regarding TTRPG development and the use of these games in educational settings lacks a consistently held taxonomy of common *ludemes*, or the actions or rules players follow when participating in TTRPGs. Indeed, many scholars have performed important work to categorize TTRPGs and distinguish them from other game types based on salient features (Hitchens and Dracher 2008; Beyers and Crocco 2016; Torner 2024; Zagal and Deterding 2024) or the learning outcomes that can be achieved from TTRPGs (Cardwell 1995; Daniau 2016; Hammer et al. 2024). Some studies have deeply analyzed unique individual player behaviors that emerge in TTRPGs, such as character development and *role-playing* adoption (Fine 1983); collaborative storytelling and worldbuilding (Tychsen et al. 2005); and performance and improvisation (Mackay 2001). However, few, if any, of the definitions or studies forwarded for TTRPGs in learning contexts have prioritized identifying and analyzing the actual ludemes that players perform as a means to play and advance the game, although such studies have been provided in the context of computer-based RPGs (Bytheway 2015; Chen et al. 2015). Because learning is inherently participatory, well-defined dimensions of

learner participation are essential for investigating gameplay as a mechanism for learning (Dickey 2005; DeBoer et al. 2014).

As such, it is important to identify the existing patterns of participation and action that actually occur within TTRPGs so that these patterns can be compared to known processes and factors of learning. *In other words, before we can speculate on how people will learn and what kind of learning outcomes will occur, we must first reliably know what people will be actively doing via their participation in the game*. Furthermore, by establishing a taxonomy of player actions at the ludeme level as well as these relationships between actions and learning processes, both instructional and game designers can develop games from a common toolkit of expected player behaviors to connect how these actions are expected to achieve desired learning outcomes. Just as a Dungeon Master or player rolls a die on a numbered table of possible outcomes, game designers and educators need a trusted list of potential player actions for their designs that can activate desired learning processes if implemented in a principled way. With this in mind, we suggest that an effective initial approach to the development of a taxonomy of TTRPG player actions is to simply investigate existing games to identify what the game rules allow, disallow, or suggest players do in open-ended role-playing contexts.

To contribute toward identifying and categorizing common player actions in TTRPGs, we conducted a systematic thematic analysis of the published text rules of one game with a large player population, *Dungeons & Dragons (D&D), 5th Edition (5e)*. In this study, we identified, categorized, and analyzed each of the individual player actions, or *ludemes*, that are afforded to players by the official game rules, as codified in the *Player's Handbook*. Because of its popularity and widespread use, *D&D* is often regarded as a quintessential example of TTRPGs in the genre as a representative case. At the time of this study, the game is currently in its 5th Edition, which was released in 2014. Although various rule systems certainly exist for tabletop *role-playing*, *D&D* is also a good case for analysis as it is historically the first TTRPG game that was played by a large population of players and remains the most popular TTRPG game in terms of sales and available associated products. This in turn has influenced the design of most other TTRPG games on the market to some degree (Ewalt 2014; Peterson 2021). Due to its widespread popularity and historical significance in shaping the world of TTRPG play, *Dungeons & Dragons* 5th Edition (*D&D* 5e) serves as the central reference point for this study.

By analyzing *D&D* 5e, the authors aim to build an understanding of how the dual structured and flexible nature of TTRPGs can facilitate diverse learning experiences. However, this does not suggest that *D&D* 5e is the definitive model for all TTRPGs, but rather a starting point for exploring a broader conversation on how different games might support varied learning objectives. We argue that investigating the archetypal case of *D&D* 5e is a good starting point for identifying the congruence of common player actions in TTRPGS and learning mechanisms that are afforded by participating in these actions on the part of the players.

The rules of the game were systematically examined for every singular player action or *ludeme* that was explicitly stated by the game rules. However, in the context of this study, only rules related to the conduct of player-characters (PCs) were included in the analysis. The singular game facilitator, often called the Dungeon Master (DM), is another type of player in the game but fulfills a far different set of functions and actions than typical players do. Instead, the DM is a facilitator who conducts many other decisions related to the conduct of the game exclusive of the players. In many educational settings that use role-playing games, the DM or facilitator role is often played by the teacher who is not engaged in the learning exercise (Garcia 2016). Because of this, the DM role and their tasks are not a part of this analysis directly, but instead studied indirectly to explore players interact with a DM. This allows the study's scope to focus toward PCs as learners within rule-based role-playing experiences. However, due to the complex relationship between players, DMs, and game tools and texts, future studies are merited toward expanding the ludemic analysis of DMs or other game facilitators and facilitation tools.

The taxonomy of ludemes identified through our analysis of *Dungeons & Dragons* 5th Edition is meant to serve as a critical layer in understanding the multifaceted learning dimensions present in TTRPGs. This taxonomy, while comprehensive within the scope of essential gameplay mechanics, represents only a portion of a potential hierarchical model of learning skills, competencies, and capabilities facilitated by TTRPG participation. At the level being presented here, ludemes represent core game actions and decisions, including character movement, combat mechanics, and dialogue choices, that are all necessary for gameplay. These actions directly engage players in the game's flexible narrative and strategic design framework, while laying the groundwork for more complex learning dynamics.

Beyond this foundational layer, there is potential for a mixture of more nuanced "tiers" of ludemes that correspond to higher-order thinking, cognitive, metacognitive, and executive function skills. Examples might include advanced problem-solving strategies; narrative analysis and creation; and collaborative decision-making processes, which all reflect a deeper level of engagement with the game's content and the social interactions born out of play. These types of "advanced ludemes" would match cognitive skills like memory and reasoning, metacognitive skills involving self-reflection and regulation, and executive functions such as planning and flexibility to the actions in the game.

It is important to differentiate between ludemes that are necessary for the main mechanics of gameplay and those that potentially enhance the learning experience but are not essential for game participation. The former is sufficient to engage players in the basic interactive narrative and rule-based structure of TTRPGs, forming the core of our current analysis. The latter representing higher-order skills and executive functions, while valuable, fall outside the immediate scope of this paper due to their less direct impact on essential gameplay mechanics. This distinction between necessary and sufficient ludemes in the context of TTRPGs points to the layered complexity of game-based learning environments. It highlights the vast potential for TTRPGs to facilitate a wide range of learning outcomes, from basic procedural knowledge to sophisticated cognitive and social skills. To this point, future research is merited that could further delineate these layers, exploring the interplay between game mechanics, player actions, and the broader spectrum of learning outcomes they may activate.

We recognize that there are undoubtedly higher-order actions taken by players that are not specified in a game's printed rules (e.g., strategy, cognitive tasks, metacognition). However, for the purposes of this paper, only specified player actions in the rules are captured as they appear in the source text, and related higher-order actions are addressed as learning processes when appropriate. Other actions and player experiences certainly exist and should be studied in future work but are beyond the scope of this study. The rules document of any game is typically the first and sometimes only resource that players use to familiarize themselves with a game and the rules of action. Thus, it is a useful exercise to investigate the intended behaviors of players from the perspective of what the design immediately affords, and this study is framed in this way. Additional higher-order actions may certainly emerge from a game, but occur as a player completes and masters the fundamental game actions that are prescribed in the game rules. Therefore, a productive first step in this work is to identify the fundamental ludemes that a game affords through its design, which is codified by the rules documentation and structure.

3. METHOD

3.1 Source Text

The entire text of the *Player's Handbook* of *Dungeons & Dragons, 5th Edition* (Wizards of the Coast 2014) was analyzed in this study for the presence of ludemes. This text was chosen as a representative

case of TTRPGs in general and was assumed to contain common ludemes in TTRPG play. Any text content appearing within the pages of this book was eligible to be coded as having the presence of a *ludeme*.

Additional rules texts for the *D&D* 5e game exist, namely the *Dungeon Master's Guide* and the *Monster Manual,* along with multiple expansion sourcebooks such as *Tasha's Cauldron of Everything*. Although these texts likely contain additional basic and advanced rules for the role of "player" (and not just the Dungeon Master), these texts were not analyzed and are outside of the scope of this study. This was decided because many players of *D&D* only use the *Player's Handbook,* and it can therefore be safely assumed that most of the basic rules for play are contained solely in the *Player's Handbook*. Additionally, the qualitative analysis of only the *Player's Handbook* was a sizable task for two researchers to complete toward identifying common TTRPG ludemes, within the scope of work for one journal article.

3.2 Procedure for Ludemic Analysis

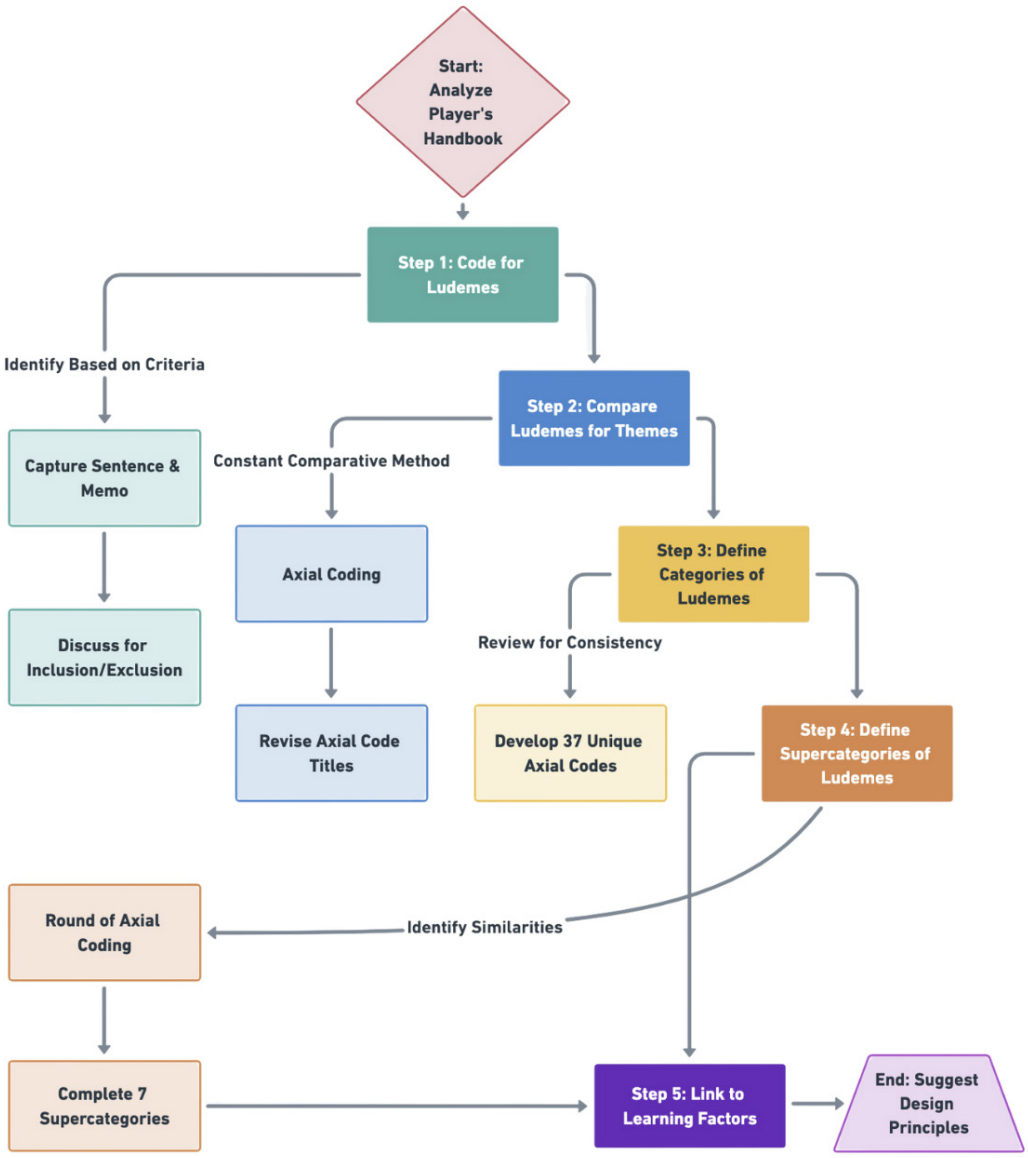
The study followed a basic qualitative thematic analysis procedure (Thomas 2006; Merriam 2009) that inductively identified generalizations from the data. This inductive process differs from deductive processes like experimental design and hypothesis testing, as it allows for the deep comparison of data points to identify similarities and differences. Similar data points are increasingly assembled to allow the categorization of similar data and allow generalized interpretations of the data to emerge (Thomas 2006). Such "from the ground up" approaches to data analysis allow for the systematic theorization of how the data are related without any predetermined categorization schemes (Charmaz 2006).

The procedure of identifying, categorizing, and interpreting ludemes from the game rules (i.e., Ludemic Analysis) consisted of the following steps: (1) the *D&D 5e Player's Handbook* was coded page by page for the presence of ludemes, resulting in coded data points of every instance of a player action; (2) each coded data point was compared categorically based on the similarity and differences of player actions performed; (3) common data points were assembled into categories of ludemes based on similarity; (4) similar ludemes were collapsed into supercategories of player actions based on similarity; and (5) the supercategories of ludemes were aligned with known educational processes and factors that influence the achievement of learning outcomes. The full qualitative analysis procedure is depicted in Figure 2.

Before textual coding began, operational definitions were determined for the two key constructs: *rules* and *ludemes*. Guided by multiple useful definitions for game rules (Salen and Zimmerman 2003; Elias, Garfield, and Gutschera 2020), we define a *rule* for TTRPG play as a statement in official game rules document that dictates how a game operates, how the game is structured, and what players may or may not do. As a type of a rule, we defined a *ludeme* as any command or rule in a game of what a player should "do" to play the game.

This definition of ludeme led to multiple inclusion criteria before text coding began. An item was considered a *ludeme* if it met any of the four following operational criteria: (1) any statement that expressly uses a verb or process in reference to a player (via process coding from Saldaña 2021); (2) any statement says something that a player potentially can or cannot "do" in the 3rd person (e.g., "players can choose to buy starting equipment for their character"); (3) any specific direction given to a player in the 2nd person (i.e., "roll a d20 and add your modifier"); (4) any noun in the text where a player action is inferred, but not expressly stated (e.g., "A passive check is a special kind of ability check that doesn't involve any die rolls", 5e *Player's Handbook,* 175). To prevent redundancy and over-coding for this study, exclusion criteria included any ludemes that were provided as specific examples of cases of player-character ludemes (e.g., "swimming" and "climbing" were not included in the ludeme of "special movement," as they were provided in the text as examples of special movement).

Figure 2. Ludemic analysis procedure: qualitative coding and categorization steps



The coding unit was at the sentence level, meaning that a data point was created with the text of the entire sentence in which a ludeme was identified. Data points were entered as rows in a Microsoft Excel spreadsheet and analyzed within the same software.

Step 1. Identified Ludemes. The first step of the analysis was to code the source text for every ludeme present within the text. Both authors served as the researchers in the data coding and analysis process. The researchers read the source text line by line and identified any ludeme cases in the text based on the inclusion criteria. For ludeme cases, the researchers discussed whether to code or not code a ludeme for inclusion in the study. When a ludeme was identified, the full text of the sentence was captured, as well as a written memo by the researcher describing the actions that are performed

by the player in the text. In addition, in line with a constant comparative methodology for qualitative analysis (Glaser and Strauss 1967), the researchers wrote additional memos on their observations that were made about each code on how it was similar and different to other codes that were encountered in the analysis.

As a result of the first round of coding from the source text, 379 individual ludemes were identified. Due to copyright restrictions, the coded sentence segments of the source text are not printed in this study, as the sentence segments consisted of a large portion of the source text.

Step 2. Compared Common Themes of Ludemes. After every ludeme was coded (n = 379), each coded ludeme data point was analyzed for similarity with other ludemes. A constant comparative method was used (Glaser and Strauss 1967), in which each code and any associated notes and memos were compared with other codes based on their similarities and differences. In this step, axial coding was employed to make formal connections between ludemes that were similar. The titles of the axial codes represented a commonality between the ludemes in the category. Additionally, because of constant comparison between codes, the titles of the axial coding categories were frequently revised by the researchers to better represent the ludeme categories.

Step 3. Defined Formal Categories of Ludemes. The axial codes for each of the 379 original ludeme codes were reviewed for consistency toward defining formal categories of ludemes based on similarity. 37 unique axial codes were ultimately developed, which represented categories of ludemes based on similar common player actions within that category.

Step 4. Defined Supercategories of Ludemes. After the 37 categories of ludemes were determined, another round of axial coding was conducted to identify similarities between the categories. From this phase of coding and refinement, 7 "supercategories" of ludemes were identified, based on common similarities between the categories.

Step 5. Linked to Learning Factors and Processes. After the supercategories of ludemes were defined, the researchers identified similarities between the types of ludemes engaged in by players and known factors that influence learning from an SCT learning perspective. Finally, the authors suggested principles for design for each supercategory based on these associations.

4. RESULTS: LUDEMES AND LEARNING IN NARRATIVE TABLETOP ROLE-PLAYING GAMES

37 unique categories of ludemes were identified through axial coding in Steps 2 and 3 of the analysis process. Each of these ludemes represents individual tasks, activities, or functions that players are instructed to do in the game rules at some point during play. With TTRPGs, it is important to remember that not every ludeme will be encountered in every session of play, and some ludemes may never be encountered by some players depending on their style of play. Additionally, some game rules that were coded belonged to two or more categories of ludeme, as they represented actions being taken in combination.

Furthermore, seven supercategories of ludemes were identified during the analysis process. Each supercategory consisted of ludemes that all had a similar, yet individually different function or action that a player performed in the game. Within each of these "families" of ludemes represented in the supercategories, there are associated parallel learning processes that accompany each type of participation. From an SCT learning perspective, the players, the DM, and game designers can

manipulate learning factors that are aligned with the types of activity that are being performed in the ludeme to maximize learning and achievement.

Each ludeme supercategory that was identified within the study is described in Table 1, with examples of individual ludemes that fall within the category being provided as well. A description of each individual ludeme (level 1) is not provided in Table 1 for brevity but are each expanded in Appendix I with a description of the ludeme.

Table 1. Categories of Ludemes (Player Actions)

Where Action Occurs	Level 2: Ludeme Supercategories	Level 1: Individual Ludemes (Player Actions)	Associated Learning Factors and Processes
Layer 1: In-Game Actions	**1. Performing an in-game action (in-character)** Total number of ludemes: 172	▪ *Traveling* ▪ *Exploring* ▪ *Communicating with NPCs* ▪ *Fighting/Combat* ▪ *Resting* ▪ *Acquiring/Using Items* ▪ *Building* ▪ *Maintaining* ▪ *Improvising* ▪ *Problem Solving* ▪ *Deciding* ▪ *Meeting Game Goals* ▪ *Encountering*	● Modeling and simulation of content, skills, expertise, and situations ● Simulation of social interactions and settings ● Conceptually integrated and embedded content or skills ● Situated cognition ● Metacognition ● Repeated practice ● Manipulation of environment ● Perception, observation, and internalization
	2. *Role-playing* (in-character) Total number of ludemes: 57	▪ *Creating Narrative* ▪ *Worldbuilding* ▪ *Descriptive Role-playing* ▪ *Active Role-playing* ▪ *Flourishing* ▪ *Staying in Role (Inspiration)*	● Narrative use in learning ● Social interaction, social mediation of game ● Engagement and fun

Layer 2: Out-of-Game Actions	**3. Receiving information and instructions (out-of-game)** Total number of ludemes: 49	▪ *Receiving Information or Instructions from DM* ▪ *Seeking and Receiving Adjudication from DM* ▪ *Receiving Information from External Materials* ▪ *Receiving Information from Other Players*	● Declarative and procedural knowledge development and use ● Media and technology use ● Using gained knowledge (via player actions / ludemes) ● Feedback mechanisms (adjudication from DM, cycles of information seeking and receiving) ● Situated cognition (using knowledge/info in contexts)
	4. Resolving actions and uncertainty Total number of ludemes: 110	▪ *Sequencing Activities* ▪ *Rolling Dice* ▪ *Evaluating Outcomes* ▪ *Resolving Actions*	● Decision making and problem solving ● Authenticity and high fidelity to real-world phenomena ● Opportunity for repeated practice ● Experiencing consequences and cause/effect relationships ● Feedback mechanisms ● Metacognition
	5. Realizing a character Total number of ludemes: 144	▪ *Setting Character Appearance* ▪ *Setting Character Attributes* ▪ *Determining Character Backstory* ▪ *Advancing the Character (Leveling Up)* ▪ *Setting Character Goals* ▪ *Expending Resources* ▪ *Revising Character Sheets*	● Learner agency and self-efficacy ● Motivation ● Identity & sense of belonging ● Observation and internalization ● Self-realization ● Influence of actions on the environment
	6. Table talking Total number of ludemes: 33	▪ *Teaming Up* ▪ *Making Group Decisions and Goals*	● Social and collaborative learning ● Metacognition ● Reflection and transfer
	7. Serving as DM Total number of ludemes: 5	*Someone has to do it!* Note: This category was derived from only the text of the *D&D* 5e *Player's Handbook*. Most rules for performing the role of DM in the game are located in the *Dungeon Master's Guide*, a separate text that was not analyzed as it was out of scope of this study.	● Facilitation ● Guiding ● Feedback mechanisms ● Reflection and transfer

Each of the seven ludeme supercategories that were identified in the study are discussed in the following sections. Within each supercategory, a description of the observed individual ludemes (i.e., player actions) is provided, the learning processes and factors that are activated by this type of ludeme are discussed, and design principles for building TTRPGs for learning are forwarded.

4.1 Performing an in-game action (in-character)

Performing in-game actions in a TTRPG context is a process that encapsulates ludemes such as traveling, communicating, fighting, problem-solving, and meeting game goals. This supercategory of player action aligns well with various Social Cognitive Theory (SCT) principles.

Starting with goal setting, players engage in explicit and implicit goal setting when they perform in-game actions (Locke and Latham 2006). Explicit goals may include completing a quest or defeating a monster. In contrast, implicit goals may include improving character skills or strengthening relationships with non-player characters (NPCs) or other party members. Goals may also represent a blend of implicit and explicit motivational drivers. Goal-setting processes relate to the activation of self-regulated learning (SRL), as players monitor progress, adjust strategies, and respond accordingly to challenges that arise during gameplay (Zimmerman 1989). This supercategory of ludeme in TTRPGs is a practical demonstration of the SCT concept of forethought, where individuals anticipate outcomes and set goals accordingly (Bandura 2001).

The performance of in-game actions is also intimately related to a player's level of self-efficacy. Consider examples that involve negotiating a peace treaty between warring factions, deciphering an ancient script, or successfully navigating a treacherous mountain pass. Performance or mastery experiences (which include the successful completion of tasks) within the game serve to boost confidence, increasing the player's belief in their ability to tackle similar or even more complex tasks in future gameplay (Bandura 1997). This theoretical example of improved self-efficacy may also be compounded by experiences where players develop self-efficacy through vicarious experiences (such as observing other players' succeeding), verbal persuasion (encouraging words from party members or the DM) and managing their physiological and emotional states during gameplay (Schunk 1995).

Cognitive and affective processes are also heavily engaged during in-game actions. The ludeme of problem-solving requires players to pay attention to the details presented by the DM, recall relevant information from their character's prior knowledge, and devise a solution effectively (Anderson 1995). The motivation to solve problems may stem from an innate desire for character advancement or achieving a shared group goal.

Lastly, performing in-game actions provides a multitude of opportunities for observational learning. Players observe the actions and strategies of others, learning new ways to approach challenges or handle interactions (Bandura 1971). This is particularly crucial in mixed-experience groups, where novice players can learn from experts (Vygotsky 1978). The socio-cultural context of the game world also shapes the players' behavior and learning (Bandura 1986). As exists in life outside the game, there are societal norms and cultural values within any game world, especially one that is dynamically socially constructed. These norms and values can influence how players interact with NPCs or handle moral dilemmas. This engages players in a complex process of social negotiation and cultural understanding, aligning with SCT's emphasis on the social and cultural factors influencing behavior and learning.

Suggested Design Principles for Learning:

- Use scaffolding to embed opportunities for varied and increasing complexity. Tasks can allow players to start with simpler tasks to build their self-efficacy and gradually introduce more complex tasks that push them to improve their skills and strategies.
- Include various NPC (non-player character) interactions that require different communication strategies. An example might be negotiating with a stubborn dwarf leader, which could require different skills than persuading a curious elf child. This variability in social interaction would require players to learn different communication strategies.

4.2 Role-playing (in-character)

Role-playing in character within a TTRPG can be seen as a manifestation of intrinsic motivation, which is a critical element of Self-Determination Theory (Ryan and Deci 2000). Viewed through this lens, it can be said that players embody their characters not merely for the game's explicit rewards but also for the internal satisfaction derived from exploring a character's personality and narrative. This phenomenon can drive players to engage more deeply with their roles in the game, thereby enhancing their learning experience (Ryan, Rigby, and Przybylski 2006).

When looking at the action supercategory of role-playing through the lens of Expectancy Value Theory (Eccles et al. 1983), the players' expectation of success and the value they attach to the successful portrayal of their characters can significantly influence their engagement and performance. Players who expect to role-play their characters well and place a high value on successful role-play are more likely to invest effort and persist in their role-play (Wigfield and Eccles 2000). Through this dynamic, role-playing starts to benefit from the impact of embodied cognition (Wilson 2002), where physical and emotional engagement in character portrayal could enhance cognitive processing and learning. The emotional investment required to authentically represent a character's feelings and reactions could also deepen the player's empathetic understanding and interpersonal skills (Goldstein and Winner 2012).

Suggested Design Principles for Learning:

- Allow space for player agency and character development so that players have the freedom to make meaningful choices that affect their characters and the game world itself.
- Introduce moral dilemmas or ethical choices that challenge players' decision-making skills and encourage reflective and reflexive thinking. Instead of having obvious "right" or "wrong" choices, these scenarios might push players to consider various perspectives and consequences, including those of their party members.

4.3 Receiving information and instructions (out-of-game)

As the DM describes scenarios or creates rules, players must hear and process this information and store it in their short-term memory and determine which important elements they need to store in their long-term memory for future retrieval. These processes are in alignment with Information Processing Theory (Miller 1956; Atkinson and Shiffrin 1968), since players are constantly receiving,

encoding, storing, and retrieving information during gameplay. This active processing enhances their understanding and retention of the game's mechanics and narrative (Baddeley 1992).

The reception of out-of-game information and instruction also relates to the principles of Direct Instruction (Rosenshine 1986). Explicit teaching of game mechanics, character development, and strategies by the DM or more experienced players is something that allows players to gain a clear understanding of the knowledge in the gameplay, often to a degree that allows the immediate application of the new knowledge. This not only increases players' proficiency but also supports their self-efficacy in gameplay (Bandura 1986).

Receiving information and instruction can also be seen through the lens of the Zone of Proximal Development (ZPD) proposed by Vygotsky (1978). This concept postulates that learners can achieve more with guidance and collaboration than they can independently. In a TTRPG setting, receiving instructions from the DM or collaborating with other players can aid in bridging the gap between a player's current abilities and potential development. The presence of guidance and instructions is also in alignment with the concept of guided discovery learning (Bruner 1961), wherein players explore the narrative and mechanics of the game, receiving support and scaffolding from the DM or fellow players as they go.

Suggested Design Principles for Learning:

- Incorporate explicit and implicit instructional elements. While players of games often learn through direct instruction (like a guide or manual), there is an additional benefit to learning through indirect instruction (learning by doing and from the consequences of their actions).
- Use a "learning by doing" mechanism instead of front-loading all the rules and mechanics. As demonstrated in the taxonomical representation of player actions in this paper, RPGs may have numerous rules and mechanisms to learn. Gradually introducing them as players encounter relevant situations in the game requires an experienced DM, but this approach aligns with the concept of situated learning and can enhance the players' deeper understanding and retention of game rules over time.

4.4 Resolving actions and uncertainty

Resolving actions and uncertainty falls under the main category of "out-of-game" player actions, but there is a significant amount of overlap between it and performing actions in-game. For example, the construct of self-efficacy, as highlighted by Bandura (1986), plays a significant role in this player action supercategory. Players' belief in their ability to successfully navigate challenges and make effective decisions in uncertain situations is central to the gameplay. Successfully resolving actions and uncertainty can strengthen this belief, enhancing their self-efficacy. This is particularly true when players face challenges that require them to stretch their abilities (Schunk, 1995).

This player action supercategory also taps into specific problem-solving strategies that take the cognitive load taken on by the player(s) into account. The nature of TTRPGs often requires players to engage in complex problem-solving under conditions of uncertainty. In doing so, players have to manage their cognitive resources effectively to process the information at hand and arrive at a solution, demonstrating the principle of intrinsic cognitive load (Paas and van Merriënboer 1994; Sweller 1988).

The process of resolving actions and uncertainty is also connected to the concept of metacognition, or "thinking about thinking" (Flavell 1979). Players need to monitor and control their

cognitive processes to navigate the game world effectively. These processes require players to reflect on their understanding, plan their actions, monitor their progress, and adjust their strategies based on the outcomes (Brown 1987).

Suggested Design Principles for Learning:

- Embracing uncertainty and randomness in game design can be a conscious decision. These elements can increase player engagement by adding unpredictability and excitement to the game.
- Integrating probabilistic elements into gameplay is an additional way to teach players about risk and reward. For example, a certain action might have a high potential reward but also a high risk of failure. Players will need to do an internal calculation in order to weigh these factors and make informed decisions as the results will impact both them and their party members.

4.5 Realizing a character

The supercategory "realizing a character" within a TTRPG context provides an array of opportunities for players to engage in learning processes. Starting with learner agency and self-efficacy, the act of realizing a character involves player decisions in regard to all aspects of the character's development, which can range from deciding on a character's appearance and attributes to determining the backstory and setting goals for the character. This process actively engages the learner's sense of agency, as they have control and ownership over their character (Hmelo-Silver et al. 2007). It also promotes self-efficacy as players see the outcomes of their decisions reflected in their character's abilities and growth (Bandura 1997).

Motivational theory also plays a significant role in this process. Creating and developing a character is an inherently motivating task when players are driven by the desire to create a unique and capable character. In accordance with Expectancy-Value Theory, which posits that individuals are motivated to engage in tasks that they value and expect to be successful at (Wigfield and Eccles 2000), players are likely to value the task of character realization due to its immediate impact on their game experience and the expected success of creating a character that can effectively navigate the game world.

One of the most significant contributions of character realization to improving the climate of education environments is the ways in which it intersects with the development of identity and a sense of belonging. Through game characters, players explore different aspects of identity, such as race, gender, profession, and personality. They can also use this game feature to express their creativity and personal interests, fostering a sense of individuality and belonging within the game world (Gee 2003). This exploration of identity can also have positive implications for the players' real-world self-concept and identity formation, particularly for younger players (Subrahmanyam and Smahel 2011).

By creating, developing, and refining their characters over time, players also engage in a process of self-exploration and self-realization (Maslow 1968). This process can also facilitate the development of skills related to self-regulation and metacognition, as players reflect on their characters' growth and make decisions about future development (Zimmerman 2002).

Suggested Design Principles for Learning:

- Encouraging character customization and development with meaningful impact on gameplay (e.g., character traits, abilities, and stats that affect game outcomes) is a design feature that may enhance a player's sense of agency, belonging, and identity within the game.
- Implementing a detailed character progression system where players can see the direct impact of their actions and decisions on their character's skills and abilities would be a complicated but valuable design element. This system should allow diverse character paths to unfold, catering to different play styles and learning preferences.

4.6 Table talking

In the context of SCT, *table talking* involves a significant amount of social, collaborative learning. As players discuss game events, mechanics, and strategies, which are all forms of collaborative learning, they exchange ideas, learn from each other, and collaboratively problem-solve, aligning with the SCT principle of reciprocal determinism (Bandura 1986). These interactions also contribute to the development of collective efficacy, where the belief in the collective's ability to accomplish tasks is cultivated (Bandura 2000).

Table talking also provides opportunities for players to reflect on game experiences and may aid in the transfer of that learning to other contexts. For example, when players discuss real-life topics, they could be making connections between the game and their real-life experiences. This aligns with the SCT's emphasis on the role of cognitive processes in learning and the idea that learning is not only behavioral but also involves deeper processes of understanding and application (Bandura 1986).

The collective decision-making inherent in table talk involves negotiation, perspective-taking, and consensus-building. These skills are valuable life skills as well as holding value in the game.

Suggested Design Principles for Learning:

- Foster collaboration and communication in the game environment. This would encourage players to discuss, negotiate, and make decisions as a group and would enhance the social and collaborative learning experience.
- Encourage cooperative problem-solving by designing challenges that require the unique abilities of multiple characters. This is often a hallmark of RPGs, and it encourages players to communicate, strategize together, and appreciate the diverse strengths of their team.

4.7 Serving as DM

Serving as the Dungeon Master (DM) is a unique role in *D&D* common to many TTRPGs that warrants distinct analysis in future work, but largely falls outside of the scope of this study due to the present focus only on player characters' actions. The DM, sometimes known as a game master or facilitator, holds a pivotal position in the game, acting as the game world's creator, non-player character narrator, rule interpreter, and facilitator of the game world's interactions. Although player-characters do not play the DM role or take any DM actions from a ludeme perspective, it is important to recognize that this role does exist in many TTRPGs and constitutes its own set of ludemes due

to the complex interplay of actions between player-characters, the DM, and the game rules, and supporting materials. In this study, ludeme references to the DM role and their actions in the *Player's Handbook* source text were captured and categorized for posterity. However, the *Player's Handbook* does not describe DM roles in detail. Instead, these rules mostly appear in the complementary source book *The Dungeon Master's Guide, 5e*, which was not analyzed in this study as it was out of scope of investigating player character actions.

From a learning perspective, the DM role provides an array of opportunities for learners. Firstly, it involves a high level of metacognitive activity, as the DM must understand the game's mechanics in-depth, anticipate player actions, manage the game world's complexity, and adjust scenarios in real time based on player decisions. This necessitates a deep understanding of the game rules, player motivations, and narrative design, fostering critical thinking, problem-solving, and decision-making skills.

From a game design standpoint, the DM role impacts the game's structure and progression. A skilled DM can adapt the game to suit the players' skill levels, interests, and learning objectives, providing a tailored gaming experience. They can modify game rules or scenarios, create custom content, and introduce novel challenges or rewards, making the game a dynamic, living system that evolves with player interaction.

While this study by design does not delve deeply into the DM's facilitative role, it is evident that this role provides distinct learning opportunities and unique challenges for game design. Future research might further explore the potential of the DM role and actions that they take in promoting learning in RPGs.

Suggested Design Principle for Learning:

- To maintain flexible and improvisational play opportunities, include a game master or arbiter to resolve potential in-game actions, to provide descriptive narration of the game world, and to promote continued engagement with play (i.e., reminding players to take action).
- Provide substantial onboarding and game master support, when possible (it's a challenging job!)

5. CONCLUSIONS

In this study, we identified and categorized a taxonomy of the unique *ludemes*, or individual player actions that could be performed in a game, that were present in an archetypal TTRPG, the 5th Edition of Dungeons & Dragons. Where most categorization schemes of RPGs are focused on structural features and descriptions of what defines an RPG, a rigorous investigation from an instructional standpoint requires the prioritization of player actions to understand how and why learning occurs. The game's potential as an educational tool is realized when the player engages with the game and adheres to its rules. Ludemes, or player actions, are pivotal markers in the learning trajectory associated with TTRPGs. These discrete gameplay elements can help educators track the evolution of a student's problem solving strategies, collaborative skills, and creative thinking. As such, our analytic tools and vocabulary in the field must support such an investigation. By investigating TTRPGs at the ludeme level, the authors forwarded a method for analyzing game rules to identify a player's possible actions in relation to the possible learning processes that are activated during participation. The definition of ludemes subsequently allows for hypothesis testing of whether learning has occurred as a result of this activity, as well as comparison across games through robust

definitions. In effect, learning occurs as a result of continual play and changing the ways one performs their player actions.

Furthermore, we suggest possible factors and processes of learning that are linked to each ludeme. However, it is important to remember that these connections remain simply hypothesized by the authors, as no empirical study was conducted with players in actual game settings. In fact, the field of educational research in general, continues to suffer from a lack of direct evidence that links the specific elements of a designed learning experience to the theoretical underpinnings that promote achievement (Cook et al. 2003; Wayne et al. 2008). Instead, drawing from our background as instructional designers, our review suggested connections between the empirically observed TTRPG ludemes within the study that are afforded to players by the game rules and the possible factors and processes that are known to facilitate learning.

Dungeons & Dragons 5th Edition was intentionally chosen as the focus of the analysis in the paper due to its broad use as well as its long-standing inspiration for the role-playing design community. Although this study represents only one specific game, we are confident that the player actions outlined in the rules of *D&D* 5e is likely representative of many common rules that span the diversity of TTRPG types and designs. In addition to the sizable task of two researchers systematically extracting ludemes from a large source text like the *D&D* 5e *Player's Handbook*, choosing just one game also intentionally gave the study a narrower focus, which allowed for modeling the analytic method (*Ludemic Analysis*) and testing out its results. In other words, it was simply as good a place as any from a place of familiarity to the researchers to start toward formally analyzing the player's role in a TTRPG game in relation to learning! In addition, it allowed us to refine a method for formal TTRPG analysis that can allow researchers to clearly define the specific game actions that are expected of players, which is especially useful when testing hypotheses of whether people learned from games as a result of their use of ludemes, or a unique combination of playstyle.

By forwarding a taxonomy of ludemes for TTRPGs, we hope that both game designers and educational researchers use this as a framework for testing the links between ludemes and learning in TTRPG play. Instead of viewing games as a singular experience, games can instead be investigated at the *ludeme level* to see how and why learning occurs when specific actions and their combinations are performed by the players. Empirical work that tests and establishes these links is worth all the gold pieces in the realm!

This study suggests significant future work in the field. Primarily, similar analyses on ludemes and their links to learning processes and outcomes should be conducted on an expanded list of TTRPG games. Furthermore, the Dungeon Master role was not thoroughly explored in this analysis, as the focus remained on the player characters and analysis of only the *Player's Handbook* among the game's library of texts. The role of the DM is a complex one, which merits its own additional study on the complex interplay of actions related to game facilitation and the players' ludemic activities. Additionally, future work could identify similarities between ludemes across games, as Parlett (n.d.) suggests that ludemes can easily be adopted from older games into newer games. If this is indeed the case, the field needs to continually grow its evidence base on the effectiveness of educational TTRPGs by empirically testing how and with what effect people learn from ludemes in varied game contexts, themes, and content. Although the analysis in this study was singly centered on *D&D* 5e, the field would also benefit from additional ludeme-level analysis of TTRPGs and larps that are expressly designed for learning will be particularly valuable for the field. Finally, it will also become increasingly important to establish programs of research that investigate emergent player actions and behaviors that are outside of the ludemes specifically outlined in TTRPG game rules, such as higher-order strategies and play styles that are assumed by players.

The primary job of an instructional designer is to match the planned actions of learners to the intended learning outcomes. For this to occur, there must be at least a hypothesized or theoretical link between the actions that will occur within the designed experience and the learning that will occur. To date, TTRPGs have shown great promise in facilitating learning, but designers have lacked a robust collection of evidence-based design principles for how to craft TTRPG games for learning. By investigating the player actions of the "world's most popular role-playing game," we hope to promote the further development of an inventory of research-based ludemes for fostering player achievement. In turn, we hope that these ludemes can be implemented and subsequently tested for learning and achievement when they are used in the service of learning.

Ultimately, this work pushes the field toward more evidence-based design principles for effective TTRPG designs for learning in all contexts (formal, informal, professional), as well as rigorous methods for formal game analysis and testing for learning contexts. The promise of role-playing games toward learning achievement is at an all-time high, but researchers and designers alike need to push the field's knowledge base past anecdotal accounts of play into more evidence-based and systematic design. This is critical for TTRPGs and role-playing methodology, in general, to be more widely accepted in both formal and informal educational settings. Designs must be testable, designed based on known learning principles, and demonstrably beneficial for learning.

This paper contributes an additional step toward this work of developing a framework of TTRPG player actions that activate learning processes; and presents a new method for formal ludeme-level analysis of complex role-playing games. It also advances principles for the design of effective learning experiences using TTRPGs. After the completion of this study, we are extremely excited about the future that gamers, designers, and educators can craft together using flexible and high-resolution role-playing methods that simulate scenarios and processes for learning!

6. CONFLICTS OF INTEREST

The authors report no conflicts of interest related to the content of this article.

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APPENDIX I: DESCRIPTIONS OF OBSERVED INDIVIDUAL LUDEMES

Ludeme Supercategory (Level 2)	Individual Ludeme (Player Action - Level 1)	Description
1. Performing an in-game action (in character) Total number of coded ludemes: 172	*Traveling*	Moving a character through the game world, often to reach specific destinations or explore new areas. Represents long-distance (e.g., from town to town) and short-distance (e.g., mere inches or yards during combat) movements in-game.
	Exploring	Interacting with the environment, investigating objects or areas, keeping watch and monitoring, and seeking out new information or opportunities.
	Communicating with NPCs	Exchanging information or dialogues with NPCs or other player characters, either verbally or through written messages.
	Fighting/Combat	Engaging in battles or skirmishes, typically involving strategic decision-making, movements, and dice rolls to determine outcomes. Fighting and combat occur at a micro-timescale, with each player turn representing 6 seconds of in-game time.
	Resting	Pausing active adventuring to recover health, spells, or other resources, as well as perform character development. This may also involve setting up camp or finding an inn.
	Acquiring/Using Items	Searching for, purchasing, or otherwise obtaining items, and employing them strategically in gameplay.
	Building and Developing	Creating structures, crafting items, or developing other tangible assets in the game world. Performing studies, research, or other character development in the game world.
	Maintaining	Sustaining or repairing equipment, fortifications, relationships, or other ongoing concerns.
	Improvising	Coming up with spontaneous actions or solutions in response to unexpected challenges or opportunities. Improvisations are facilitated and adjudicated by the Dungeon Master.
	Problem-Solving	Analyzing a complex situation or puzzle and devising a strategy to overcome it.

	Deciding	Making choices that impact character actions, opportunities, plot direction, or other aspects of the game.
	Meeting Game Goals	Accomplishing objectives set forth by the game's narrative or the DM.
	Encountering	Discovering new creatures, characters, or events, often leads to further actions or decisions.
2. *Role-playing* (In Character) Total number of coded ludemes: 57	*Creating Narrative*	Contributing to the storyline or plot of the game through character actions and interactions.
	Worldbuilding	Contributing to the development and detail of the game setting, often in collaboration with the DM and other players.
	Descriptive Role-playing	Providing detailed descriptions of character actions, expressions, or surroundings to enrich the game world.
	Active Role-playing	Engaging deeply with the character's persona, making decisions consistent with the character's personality and backstory.
	Flourishing	Adding creative, often non-essential, details or actions that enhance the *role-playing* experience and deepen character immersion.
	Staying in Role (Inspiration)	Consistently acting and speaking as the character, including the use of accents, catchphrases, or mannerisms. Being awarded *inspiration* by the Dungeon Master for strong in-character role-playing.
3. Receiving information and instructions (out-of-game) Total number of coded ludemes: 49	*Receiving Information or Instructions from DM*	Listening to the DM's narrative, descriptions, and rule explanations.
	Seeking and Receiving Adjudication from DM	Requesting the DM's decision on rules questions or ambiguous situations.
	Receiving Information from External Materials	*(texts/media/game resources/game pieces)* Reading or consulting rulebooks, maps, character sheets, or other game resources.
	Receiving Information from Other Players	Listening to or seeking advice, strategies, or perspectives from fellow players.
4. Resolving actions and uncertainty Total number of coded ludemes: 110	*Sequencing activities*	Determining the order in which actions occur, is often important for coordinating individual or group actions, or reacting to events.
	Rolling Dice	Using dice rolls to add randomness to game outcomes, often tied to character abilities or difficulty checks.
	Evaluating Outcomes	Assessing the results of actions or events, determining degrees of success or failure.
	Resolving Actions	Finalizing the outcomes of character actions, often involving the interpretation of dice rolls and game rules.

5. Realizing a character Total number of coded ludemes: 144	*Setting Character Appearance*	Choosing physical attributes, clothing, and other visual elements that define the character's look.
	Setting Character Attributes	Determining the character's abilities, skills, strengths, and weaknesses, often guided by race, class, and dice rolls.
	Determining Character Backstory	Creating a personal history for the character that explains their motivations, personality, and place in the game world.
	Advancing the Character (Leveling Up)	Improving the character's abilities or acquiring new ones, usually as a reward for gaining experience points.
	Setting Character Goals	Defining objectives or desires that guide the character's actions and development.
	Expending Resources	Things that exist outside of the game (Hit Dice, etc.) - could be simulated in-game, but are out-of-game character decisions (about the character, not by the character). Making decisions about using character resources such as hit points, spell slots, equipment, or money.
	Revising Character Sheets	Updating the character's written record to reflect changes in attributes, equipment, experience, and other details.
6. Table talking Total number of coded ludemes: 33	*Teaming Up*	Forming alliances or partnerships with other player characters for mutual benefit.
	Making Group Decisions and Goals	Collaborating with other players to decide on a course of action or shared objective.
7. Serving as DM Total number of coded ludemes: 5	Note: Most rules for performing the role of DM in the game are located in the *Dungeon Master's Guide*, a separate text that was not analyzed.	*Someone has to do it!* The activity of managing the game world, the narrative, and the rules. This can involve everything from creating scenarios and playing NPCs to adjudicating rules and moderating player disputes. This is a distinctly different role from the player characters and has its own set of skills and challenges. This was not investigated in depth in this study.

Jeremy Riel, Ph.D., is Visiting Assistant Professor of Educational Psychology at the University of Illinois Chicago. His research is at the intersection of educational technology, learning sciences, and productive play. His work focuses on research and development of educational technologies and learning experiences in play-based and scenario-based settings, with a particular focus on emerging technologies, such as educational simulations and digital games, asynchronous and distributed online learning, AI, digital communications and media, and immersive sensory technologies.

Rob Monahan was a NYC Pre-K - 5th-grade science teacher for 13 years, creating and piloting new programs for public schools, including the city's first explicit K-5 critical thinking course. He started his private education consulting business, STEM Passport, about 12 years ago and currently works with students internationally and across the US. Monahan's primary area of expertise is using commercial games and gamification as teaching, learning, and motivational tools. As of the publication date, he is starting the dissertation phase of a Ph.D. program in Teacher Education and Learning Science at NC State.