



Developing An Interactive Gaming Software On Intellectual Property Awareness For School Students

In education industry

¹Dr. Vishwanath Y, ²K Mohammed Kaif Beg, ³Akshay Rathod, ⁴Abhishek, ⁵Niranjan prasad

¹Assistant professor, ²Student, ³Student, ⁴Student, ⁵Student

¹Department of Computer Science and Engineering,

¹Presidency University, Bengaluru, India

Abstract: The aim of this project is to develop an interactive and fun gaming application so that school students can have fun while learning Intellectual Property Rights. Patents, Trademarks, Copyrights, and Industrial Designs are referred to as Intellectual Property. These are important concepts, but in most cases, they are taught in either boring or technically difficult ways for younger students. To counter this notion, we imagined a web game that used game techniques for an exciting and effective learning experience. The application consists of six different game modes: Puzzle, Time Challenge, Role-Playing, Quiz, Case Study, and Drag- and-Drop. Each mode comes with three levels: Basic, Intermediate, and Advanced. Students can unlock new games and challenges and earn points by playing the games and completing levels. The game incorporates a leaderboard and badges to motivate and allow students to track their progress. A modern stack of technologies was utilized in the making of this platform. The front end was built using React.js and Phaser.js, and the back end was implemented using Node.js and Express.js. The data is stored using a SQL-based database, while the user authentication and encryption ensure that the entire platform is secure. This game does not only provide entertainment but is also a significant way of helping learners retain information better than conventional class methods. It enables instructors to monitor the performance of their students, while learners explore the IPR concepts independently. The platform supports various devices such as phones, tablets, and computers.

I. INTRODUCTION

Intellectual Property Rights (IPR) are extremely significant in the modern era. They safeguard ideas, inventions, brand names, and creative works such as music, books, and art. Most individuals are not well aware of IPR, particularly school students. However, educating them about these rights at a young age will make students realize the significance of creativity and innovation. It also makes them more conscious of others' work being respected. Traditional teaching methods for IPR, like lectures and textbooks, are normally dull and hard for students to comprehend. Because of this, they tend not to know or remember what they have been taught. In order to overcome this issue, our project centers on utilizing games in making IPR learning engaging, interactive, and simple. We are creating an online game application for students that will educate them about the fundamentals of IPR in a fun and engaging manner. The game offers six modes: Puzzle Mode, Time Challenge, Role-Playing, Quiz, Case Study, and Drag-and-Drop. All the modes have been created to educate students about IPR in small, manageable steps. Students will be

able to begin from the Basic level and then progress to Intermediate and Advanced levels as they learn more and more the game also features aspects such as scoring, leaderboards, and achievement badges to keep the students motivated and eager to learn. The game is available on phones, tablets, and computers, making it possible for students to play and learn from anywhere by employing games rather than textbooks, we facilitate students to learn and retain IPR concepts more easily. This also benefits teachers by providing them with a means to make their classes more interactive.

II. LITERATURE SURVEY

Many researchers and educators have explored the importance of Intellectual Property Rights (IPR) and how to teach them effectively. Most agree that students must understand IPR from a young age, as it helps them value original ideas, respect others' work, and be aware of their own rights when creating something new. In traditional classrooms, IPR is often taught through textbooks and lectures. However, these methods may not keep students interested, especially school-aged children. A study by *Brophy and Alleman (2007)* found that children learn better when lessons are interactive and connected to real-life situations. This shows that new teaching methods are needed to improve IPR education. Game is one such modern method. It means using game elements—like points, levels, rewards, and challenges—in non-game environments, such as education. *Deterding et al. (2011)* explained how gamification increases student interest, motivation, and involvement. Games make students curious and excited to learn, which can lead to better understanding and memory of what they've learned. Several educational games have already been successful in teaching complex subjects. For example, *Kahoot!* is a quiz-based game used in classrooms across the world to make learning fun. *Duolingo*, a language-learning app, uses points and streaks to help users learn new languages. These tools prove that when students enjoy the learning process, they are more likely to stay engaged and succeed. When it comes to teaching IPR specifically, not many tools or games are available yet. Some websites and short videos explain IPR concepts, but they are not designed for younger learners. A few colleges use IPR-based quizzes, but these are mostly for older students and are not very interactive. Our project fills this gap. It aims to bring IPR education to school students in a fun and engaging way through a web-based gaming platform. We have included multiple game modes like puzzles, role-playing, quizzes, and drag-and-drop games. Each mode helps students learn in different ways, based on their interests and learning styles. Studies have also shown that interactive learning platforms can improve retention (memory) and understanding. *Clark and Mayer (2016)* emphasized that students remember more when they actively participate in their learning. Our application is built on this idea, using games to create an active and enjoyable learning experience. In addition, learning analytics—like scores, badges, and leaderboards—can help teachers track student progress and identify where they need help. This makes the platform useful not just for students, but also for educators who want to improve their teaching methods.

To summarize, there is a strong need for innovative and interactive tools to teach IPR. While research supports gamification as an effective method for learning, very few projects have focused on using it for IPR education. Our project is one of the first steps towards making IPR learning fun, simple, and accessible for school students. Although gamification has been found to be highly effective in enhancing learner engagement, its use specifically for legal or rights-based subjects such as Intellectual Property Rights (IPR) remains limited. Educational resources for IPR are generally developed for tertiary education, law students, or professionals. The resources tend to be text-heavy and not adapted for school-level learners. This calls for additional age-appropriate, simplified material that school students can readily follow. In addition, in research by Hamari et al. (2014), they discovered that games involving rewards, challenges, and feedback loops can enhance learning as well as motivation, particularly when the content is segmented into short, relevant lessons. The results justify the design of our app, involving levels of difficulty, immediate feedback, and graphical rewards such as badges. With web technologies like React.js and Phaser.js, it has become simpler to develop interactive and cross-platform learning tools in recent times. These technologies enable game developers to create games that are responsive, fast, and compatible with various devices like phones, tablets, and computers. This makes sure that students can access the learning content anywhere, anytime. Through the integration of robust gamification, technology, and pedagogical research, our project is a solution sorely needed to fill the gap between conventional IPR education and contemporary, interactive learning tools created for young children.

III. METHODOLOGY

1 System Architecture Design

The system follows a three-tier architecture for efficient data flow and user interaction:

- **Frontend (User Interface):** Built using React.js and Vite, it provides a responsive and interactive user experience for students.
- **Backend (Server Logic):** Developed using Node.js with Express.js, the server processes user inputs, handles scoring and game logic, and communicates with the database.
- **Database Layer:** SQL database is used to store game progress, user scores, and achievements in real time.

2 Front-End Development

- **Technologies Used:** React.js, Vite, Phaser.js for game rendering
- **UI/UX Design:**
 - The interface is designed for intuitive navigation with clearly defined game modes and progress indicators.
 - Tooltips and pop-ups explain game mechanics and Intellectual Property Rights (IPR) concepts.
- **Interactive Features:**
 - Users can navigate through six game modes using buttons, tabs, and interactive elements.
 - Hints and power-ups enhance user engagement.

3 Back-End Development

- **Technologies Used:** Node.js with Express.js to store game data, and maintain a seamless gaming experience.
- **Functionality:**
 - Handles real-time user progress tracking, leaderboard updates, and game state management.
 - Implements a scoring system to evaluate player performance across different game modes.
- **API Integration:**
 - Supports leaderboards and analytics for tracking user engagement.
 - Future integration of AI-driven personalized hints and learning recommendations.

4 Database Design and Integration

- **Technology Used:** SQL is used as the database to store game data efficiently.
- **Schema Design:**
 - **Users Collection:** Stores student profiles, including name, scores, and game progress.
 - **Game Modes Collection:** Maintains information on different challenges and difficulty levels.
 - **Leaderboard Collection:** Records high scores and achievements for competition among players.

5 Security Design

- **Authentication:** User authentication will be handled using JWT (JSON Web Tokens) to ensure secure login sessions.
- **Data Encryption:**
 - User credentials and game progress data will be encrypted using AES encryption.
 - HTTPS ensures secure communication between the client and the server.
- **Access Control:**
 - Different roles (student, teacher, admin) will have controlled access to certain functionalities.

6 Testing Design

- **Unit Testing:** Individual modules like user authentication, scoring, and leaderboard will be tested separately.
- **Integration Testing:** Ensures smooth interaction between the front-end, back-end, and database.
- **User Acceptance Testing (UAT):** Conducted with students and educators to evaluate usability and engagement.

7 Deployment

- **Hosting:** The platform will be deployed using AWS or Heroku for scalability and reliability.
- **Continuous Integration/Deployment (CI/CD):** Using GitHub Actions for automated testing and deployment.
- **Domain and SSL:** The game will be accessible via a custom domain with SSL certificates for secure browsing.

8 Maintenance and Future Enhancements

- **Regular Updates:** Continuous monitoring and bug fixes to enhance the user experience.
- **Future Enhancements:**
 - Expansion of game modes with new challenges.
 - AI-driven tutoring system for personalized learning.
 - Multilingual support for wider accessibility.

IV. SYSTEM FEATURES

1 Several Game Modes:

The site provides six engaging modes of learning, such as Puzzle Mode, Quiz Mode, Time Challenge, Role-Playing, Case Studies, and Drag-and-Drop exercises. All the game modes are intended to educate IPR subjects such as patents, copyrights, and trademarks in an engaging and simple manner. This diversity keeps students engaged and interested in the learning process.

2 Three Learning Levels:

To make learning smooth and comfortable for every student, the game is divided into three levels: Basic, Intermediate, and Advanced. New comers can begin with easy questions and gradually proceed to harder ones. Gradual learning in steps helps students develop a solid understanding without getting overwhelmed.

3 Score and Leaderboard System:

The platform implements a point-based system where students get scores for correct responses and task completion. The leaderboard indicates the top-scoring students, which creates healthy competition among the students. Learning becomes more fun and engaging and motivates students to perform better.

4 User Login and Progress Tracking:

Every student is able to register for their own account and log in safely. Their results, levels, and progress are stored, so they can go back and resume where they left off. This also enables teachers to track students' progress and provide assistance if necessary.

V. PROPOSED WORK

The primary objective of our project is to design an entertaining and interactive web-based platform to assist school students in learning Intellectual Property Rights (IPR). Because this subject is not typically taught in an interactive manner, particularly at the school level, we intend to develop a solution where we utilize games to educate vital IPR elements such as patents, copyrights, trademarks, and designs. We recommend the development of a system with several game modes that provide learning in an interesting and engaging manner. These game modes are:

1. puzzle Mode: Students solve puzzles that enable them to learn the significance and meaning of IPR subjects.
2. Time Challenge Mode Students respond to IPR- related questions in a limited amount of time, which enables them to do so quickly.
3. Role-Playing Mode: Students participate in real- world scenarios where they must make choices according to IPR regulations.
4. Quiz Mode: A basic question-and-answer interface where students try out their IPR knowledge.
5. Case Study Mode: Students read brief stories or scenarios and select the appropriate IPR action.
6. Drag-and-Drop Mode: Students align IPR terms and definitions by dragging them to the right spot.

Every game mode will have three levels—Basic, Intermediate, and Advanced—so students can gradually improve. The system will also contain score tracking, leaderboards, and badges to make learning competitive and rewarding. These features will motivate students to continue playing and learning. To build the platform, we'll employ React.js on the front-end side. This will enable us to create a quick, user-friendly, and responsive user interface. We'll utilize Phaser.js to create the actual gameplay activities since it's a well-used framework for 2D games. We'll utilize Node.js and Express.js on the back end to handle data and user interactions. All user progression, scores, and game material will be stored securely in a SQL database.

We also intend to add a login feature so that students will be able to create their own profiles. Their work will be saved and they will be able to resume learning anytime. Teachers will also be able to monitor student performance through future dashboards that we will add. In order to make the learning process even more effective, we are going to incorporate AI-based recommendation in the future. This will involve the platform analyzing each student's performance and providing them with personalized learning recommendations. We will also implement multiple languages so that students from various locations can learn with ease.

Our process will proceed through the following steps:

1. Research and planning
2. Game structure and flow design
3. Designing front-end and back-end systems
4. Designing game content in relation to IPR
5. Testing using real users (students)
6. Gathering feedback and refining the platform

VI. System Design and Implementation Approach

Our project is centered on the development of an interactive web-based gaming software for raising awareness of Intellectual Property Rights (IPR) among school students. In order to turn this vision into a reality, we adopted a systematic and user-centric system design and implementation methodology. The process of development involves several phases such as planning, designing, building, testing, and polishing the application.

1. **Frontend Design and Development:** Frontend or user interface of the app is implemented with React.js, an open-source JavaScript library, and Vite a fast development tool. React enables us to create interactive elements like menus, game boards, progress maps, and game instructions. The user interface is made simple, colourful, and usable so that students can interact with the game comfortably. We made sure that the design is responsive, i.e., it adapts automatically to varying screen sizes. Whether the student is working on a desktop, tablet, or smartphone, the application appears and functions fine. This is highly critical in terms of reaching a larger audience and facilitating learning from school as well as home environments.
2. **Game Development with Phaser.js:** The interactive game modes are developed through Phaser.js, a robust HTML5 game engine. Phaser enables us to incorporate animations, movements, and user interactions seamlessly. With this tool, we developed six game modes:

- Puzzle Mode
- Time Challenge Mode
- Role-Playing Mode
- Quiz Mode
- Case Study Mode
- Drag-and-Drop Mode

Each of these modes provides a different learning style. For instance, the Role-Playing Mode assists students in playing the role of IP agents, whereas the Puzzle Mode develops analytical skills. Each mode is split into three levels: Basic, Intermediate, and Advanced, assisting students in learning from simple to advanced concepts incrementally.

3. **Backend Development:** The backend is coded in Node.js and Express.js. This section of the system performs all the server-side operations such as storing student data, scores, progress, game content, and achievements. It also integrates with the frontend so student data and game performance can be stored and displayed in real-time. This design allows for easy game performance and support for several users simultaneously. It also allows for effortless future updates of content or addition of new features.
4. **Scoring, Progress, and Gamification:** We used a scoring system where students score points based on their speed and accuracy in completing tasks. A leaderboard shows high-scoring players to encourage students to play better. Players can earn badges and rewards for achieving achievements such as completing all Basic levels or achieving 100% in a mode. This gamification method increases motivation, attention, and time invested in learning. It makes the learning experience more interesting than conventional classroom approaches.
5. **Content Delivery and Learning Support:** To aid learning, we included a Content Delivery Module. The module delivers informative content such as definitions, real-world examples, fun facts, and in-game hints. The students can access these while playing the game. These features assist students in understanding IPR concepts. There are also power-ups and hints to be earned that students can use while playing to assist them in progressing when they are stuck.
6. **Cross-Device Compatibility:** One of our key objectives was to make the application usable on all devices. The whole system is designed to be browser-based, i.e., there is no app installation required. Students can play the game with a web browser such as Chrome, Firefox, or Safari, on any device—laptop, mobile phone, or tablet. This provides maximum coverage and ease of use, particularly for schools that have varying types of digital configurations.
7. **Testing and Debugging:** For quality assurance, the system is periodically tested throughout and after development. Every module is reviewed for bugs, glitches, or anomalous behaviour. We also conducted user experience testing with feedback from school children to ensure that the game is enjoyable and easy to grasp.
8. **Future Scalability:** The system is made scalable so that additional features such as multilingual support, AI tutoring, or additional game modes can be implemented in the future. This makes sure that the platform can expand and still be able to cater to more students in the future.

VII. BENEFITS

1. **Gamified Learning Experience:** Makes IPR education fun and engaging using points, badges, levels, and leaderboards.
2. **Simplifies Complex Legal Concepts:** Breaks down IPR topics like patents and trademarks into easy-to-understand, interactive modules.
3. **Multiple Learning Styles Supported:** Six game modes offer visual, logical, and experiential learning suited to different types of learners.
4. **Progressive Learning Levels:** Basic, Intermediate, and Advanced levels allow students to build knowledge step-by-step at their own pace.
5. **Performance Tracking & Resume Feature:** Student progress, scores, and achievements are saved, allowing them to continue where they left off.
6. **Cost-Effective and Wide-Reach:** Web-based and free to use, making it accessible to students across varied

educational settings.

VIII. Challenges and Limitations

Challenges

- **Designing Content for Young Learners** It was challenging to design IPR-related content that was simple, easy to read, and appropriate for school students. It meant breaking legal jargon into entertaining, simple words. Ensuring data security and compliance with industry standards posed significant challenges.
- **Finding the Right Balance of Fun and Learning** keeping the game both fun and educational was tricky. Too educational, and it felt like a lesson; too much fun, and it would lose the mission of raising awareness.

Limitations

- **Internet Dependency** Being web-based, it needs an active internet connection. Students from areas with limited connectivity may encounter difficulty accessing it.
- **At present, the game is offered in English alone.** Students who are not proficient in English might have difficulty following a few sections.

IX. CONCLUSION

The objective of this project was to develop an entertaining and engaging method for school children to learn about Intellectual Property Rights (IPR). These subjects are highly relevant in the current world, but they are normally taught in a very formal or dull manner. Our intention was to make learning fun, simple to grasp, and significant by making it a game that students would enjoy playing. To accomplish this, we created and implemented a web-based gaming application with the latest technologies such as React.js, Phaser.js, Node.js and Express.js. These technologies enabled us to create a system that is responsive, fast, and compatible with various devices such as computers, tablets, and mobile phones. We designed six distinct game modes: Puzzle Mode, Quiz Mode, Time Challenge Mode, Role-Playing Mode, Case Study Mode, and Drag-and-Drop Mode. Each of these modes was designed to educate IPR subjects in a unique manner, so that the learning process is engaging and new each time.

These game modes are also categorized into three levels—Basic, Intermediate, and Advanced—so that students can progress from simple to more complex material at their own convenience. The game also features a scoring system, leaderboards, badges and awards which keep students engaged and provide a reason for them to return to play more. This approach, referred to as gamification, assists in making learning exciting, where the students feel they should be proud of themselves if they perform well. It promotes good competition between students.

Another nice aspect is the content delivery module. It presents students with useful information such as tips, definitions, examples, and fun facts while playing. So although they may know very little about IPR to begin with, they gradually start learning as they navigate through the game. Technically, the system is scalable, modular, and maintainable. That is, in the future, new content, new features, or new languages can be incorporated without modifying the entire system. We also ensured that the design is responsive, so students can play the game on any device with a web browser, without having to download an application. Even with all these accomplishments, we had a couple of challenges. One of the greatest challenges was how to plan the content so that it was appropriate for school students. IPR can be a challenging subject, so we simplified the language and made it age-friendly. Another challenge was how to balance learning and fun. If the game was too entertaining, students would forget to learn. If it was too educational, they would get bored. We had to strike the right balance. There were also some limitations. As the game relies on the internet, students in places with poor internet connectivity may have issues. Also, the game is available only in English now, which could be challenging for students who prefer other languages. These are areas we want to work on in the future.

In summary, this project demonstrates that serious subjects such as Intellectual Property Rights can be taught in an entertaining, interactive, and student-centered manner. By merging education with entertainment, we

have developed a system that not only educates students but also keeps them interested. We think this game can be an effective tool for schools, teachers, and students nationwide. In the coming days, we plan to introduce more features, implement multi-language support, and even collaborate with schools or education boards to target a larger group of people. With proper support and feedback, this system can grow into an effective platform for imparting knowledge on IPR and other vital topics through interactive learning.

This project was designed to educate school students about Intellectual Property Rights (IPR) in an interesting and engaging manner. IPR is a significant topic, but it is not typically taught in an interesting manner for young students. To address this, we designed a web-based game that makes learning fun and exciting. The system comprises six various game modes—Puzzle, Quiz, Time Challenge, Role-Playing, Case Study, and Drag-and-Drop. All the game modes instruct IPR concepts in a unique manner, and hence, the experience is more fun and engaging. These games are further categorized into three levels Basic, Intermediate, and Advanced, which allow students to learn step by step. The game was developed with contemporary technologies such as React.js for the front end, Phaser.js for game development, and Node.js with Express.js for the back end. The system is operated on all devices including mobiles, tablets, and laptops so that students can use it anytime, anywhere.

REFERENCES

- [1] Matsumoto, K., & Tanaka, Y. (2018). Innovative Approaches in Digital Insurance and Consumer Trust. *Journal of Digital Economics*, 12(3), 45–58.
- [2] Gee, J. P. (2007). *What Video Games Have to Teach Us About Learning and Literacy* Palgrave Macmillan.
- [3] Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining Gamification Proceedings of the 15th International Academic MindTrek Conference, 9–15.
- [4] Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work?—A Literature Review of Empirical Studies on Gamification Proceedings of the 47th Hawaii International Conference on System Sciences, 3025–3034.
- [5] Prensky, M. (2001). *Digital Game-Based Learning*. McGraw-Hill.
- [6] Anderson, C. A., & Dill, K. E. (2000). Video Games and Aggressive Thoughts, Feelings, and Behavior in the Laboratory and in Life. *Journal of Personality and Social Psychology*, 78(4), 772–790.
- [7] Resnick, M. (2007). Sowing the Seeds for a More Creative Society Learning & Leading with Technology, 35(4), 18–22.
- [8] Kapp, K. M. (2012). *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. Pfeiffer.
- [9] Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A Systematic Literature Review of Empirical Evidence on Computer Games and Serious Games. *Computers & Education*, 59(2), 661–686.
- [10] Van Eck, R. (2006). Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless*. *EDUCAUSE Review*, 41(2), 16–30.
- [11] Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pages, C., & Martínez-Herraiz, J. J. (2013). Gamifying Learning Experiences: Practical Implications and Outcomes*. *Computers & Education*, 63, 380–392.
- [12] Suh, A., & Wagner, C. (2017). How Gamification of an Enterprise Collaboration System Increases Knowledge Contribution: An Affordance Approach. *Journal of Knowledge Management*, 21(2), 416–431.
- [13] Alsawaier, R. S. (2018). The Effect of Gamification on Motivation and Engagement International Journal of Information and Learning Technology, 35(1), 56–79.
- [14] Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, 108(6), 1017–1054.
- [15] Chen, C. H., & Tsai, C. C. (2009). The Use of Online Feedback Tools for Enhancing Student Performance and Learning Motivation Educational Technology & Society, 12(1), 127–139.