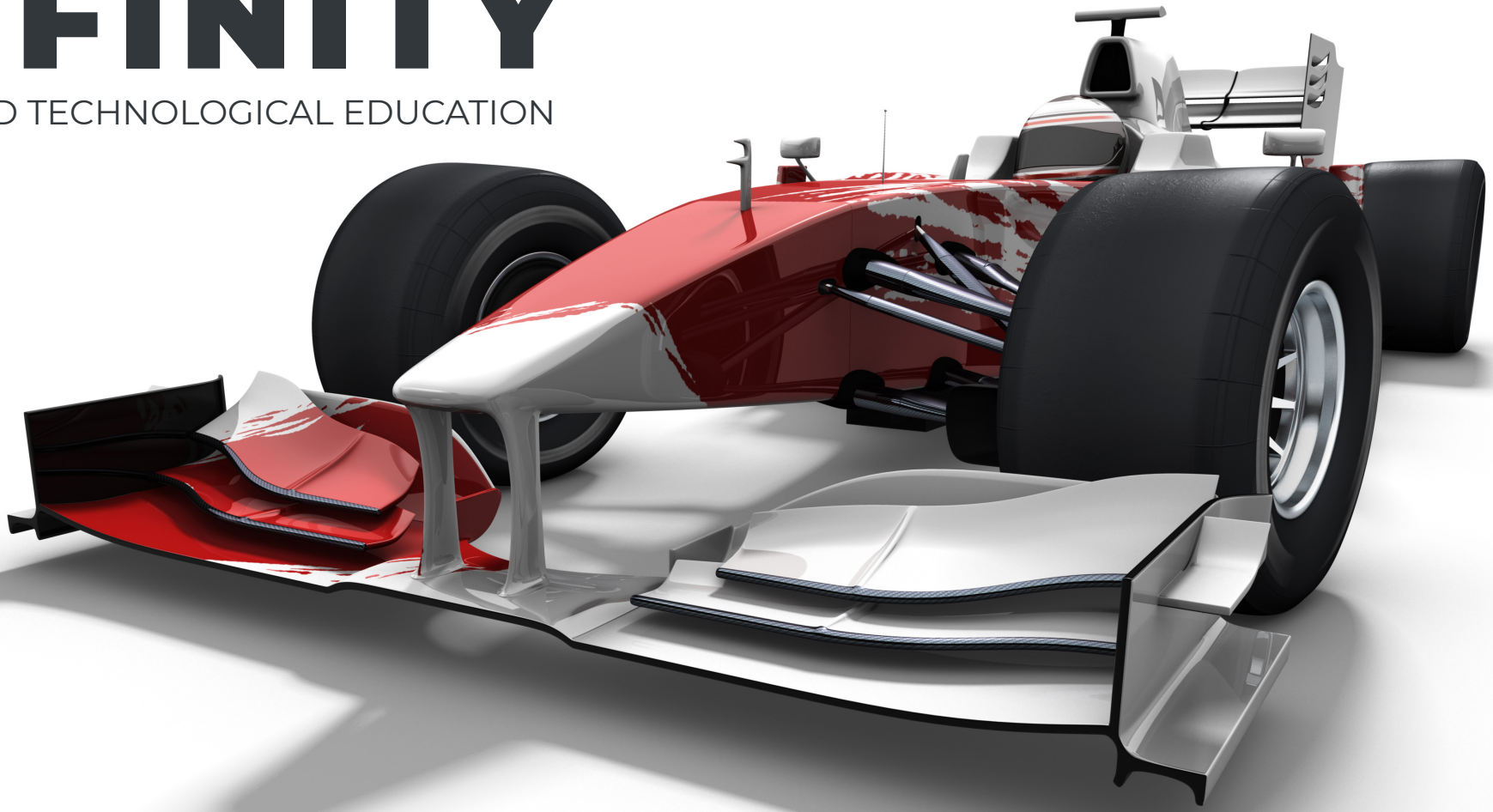
PROJECT IDEA 28.04.2020

FORMULA INFINITY

GAMIFIED TECHNOLOGICAL EDUCATION



DESCRIPTION OF A GAME PROJECT IDEA

FORMULA INFINITY

EXECUTIVE SUMMARY

TEAM INFINITY

A waning interest in engineering-based educational pathways amongst the youth of today does little to meet the demands of modern industry. Despite many years of effort to increase interest in the fields of science and engineering, no significant change in attitude has been identified — particularly, the number of women attending engineering programs remains steadily low. Maybe it's time to meet the new generation on their home turf? The fact that about 80% of today's youth in Sweden consider themselves to be gamers might be an opportunity. Can computer games awaken latent dreams of becoming engineers, and prepare future students with digital competence and an understanding of high-tech systems? This document outlines ideas for the concepts of such a game.

Formula Infinity envisions a pedagogical racing game where players can construct and compete with their own virtually built race cars. By combining e-sports with authentic engineering education in a digital environment, we aim to forge a genuine interest and understanding of engineering science and technology. Formula Infinity is a racing simulator that mimics real racing, and where the engineering team is just as important as the driver. Within the game, every machine element or electronic device is modelled in a state-of-the-art physics engine. This idea can be seen as a virtual counterpart to the well-known concept of Formula Student, in which university students all around the world build real race cars for competition. Formula infinity is, however, not limited to the context of event racing. We aim to design a game that's enjoyable as well as educational — at any level and at any age!

The content of Formula Infinity will be structured in such a way that the player is in control of choosing their level of interaction with the vehicle. For example, a novice player would drive a pre-built car and learns basic adjustments, like changing wheel or gear settings. As technical interest grows, the player should be able to further explore any system of the car, with the help and mentorship of a virtual engineer. Bit by bit, the player might be inclined to try and modify the car's construction. The player will then have the option to learn how to design a race car from scratch, in pedagogical increments. For the competitive gamer, the dream of winning races will add extra motivation to dig even further into the science and technology of race cars.

In short, this is what Formula Infinity is all about —

- A gamified learning platform that increases interest in engineering science and technology
- A virtual teaching tool specifically related to education in engineering
- A communication opportunity between the gaming community and schools / industry

INITIATORS

Project Management

Petter Sjöstrand *petter@formulainfinity.com*
Hans Löfgren *hans@formulainfinity.com*
Barrett Sauter *barrett@formulainfinity.com*

Blekinge Institute of Technology

Christian Johansson
Tobias Larsson
Johan Wall

Chalmers University of Technology

Ola Benderius
Petter Falkman
Knut Folkesson

University of Gävle

Kourosh Tatar

Halmstad University

Martin Bergman
Hans-Erik Eldemark
Kalle Jonasson
Patrik Lilja
Sabina Rebeggiani

University West
Mats Larsson

Karlstad University

Kent Evermark
Anders Gåård
Tobias Pulls

Royal Institute of Technology

Ellen Bergseth

Linköping University

David Beuger
Fredrik Henriksson
Johan Persson

Linnaeus University

Mats Almström
Samir Khoshaba
Andreas Linderholt
Leif Petersson

Luleå University of Technology

Kim Berglund
Marcus Björling

Lund University

Mats Andersson

Mälardalens University

Anders Berglund
Bengt Erik Gustafsson
Leo Hatvani

Swedish Car Sports Association

Niklas Falk
Felicia Grundtman
Eric Stranne

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The game idea

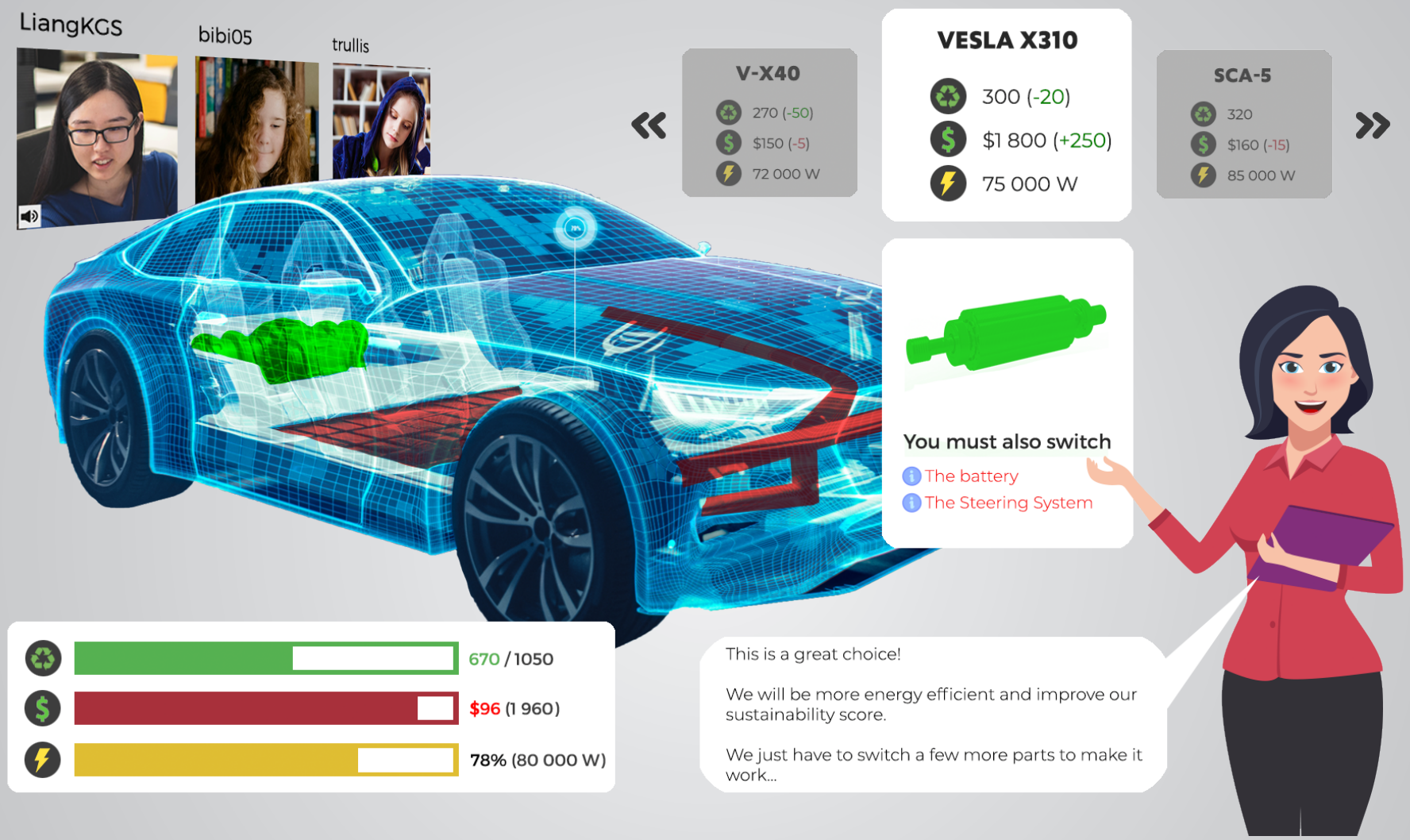
A racecar is a system of many interconnected subsystems and components. It includes everything from sensors, machine elements and control components to subsystems such as powertrains and computer systems. These all co-operate in making up the concept of a car as a whole. To master all these parts is very challenging, though not impossible, and might make up the ultimate challenge for a player of Formula Infinity. This type of systems thinking is hard to reach within the frames of an engineering education and would therefore be a welcome complementary part of many courses. The construction work within the game would still have to be confined to specialized digital workspaces for each technical field, that would entail virtual testing labs and workshops for mechanical, electrical and software systems.

In a virtual workshop, there's all you would ever need. Good teachers (virtual engineers) and interactive information systems with varying entry levels give examples and guidance to solutions. Each component has its own documentation with pedagogical 3D blueprints, physical models, price tags and data. To enable exploration and technical systems understanding, there would be a need for support systems that automatically simulate your constructions. This will give direct feedback on your choice of materials and components as well as invite you to play around with the technology. Changing a subsystem should be quick and simple, and testing it out on a racetrack or in a laboratory should be immediately available. In this process, you would also learn all the technical terms that are important for an engineer. Under the hood, state of the art models run the simulations - and will become available to the more advanced players as they dig deep into the game. This gives even a specialist an important opportunity to expand on their knowledge in the broader picture.

At its core, vehicle sports are technology centered, and the engineer is as important as the driver. Every race track is unique, with its own curves, flats and slopes. If you add the possibility to create imaginative virtual environments and weather effects, there's an infinite possibility for engineering challenges to solve. Every car is constructed for its racing genre and type of track. This defines the overall design of the car. However, it isn't before the driver and the team gets access to the actual racetrack where the majority of small adjustments will be made for the car to perform optimally.

Besides the actual racing, many performance tests can be competitive as well. To be an engineer means to find the best solution given a frame of limited possibilities. Sustainability, price, environment and weight can all be scoring categories. Engineering can also be beautiful; design and aesthetics are an important category to compete and excel in as well.

An interesting possibility is to let universities compete against each other in national competitions to create publicity and possibilities for broader competitions where anyone can qualify. As Formula Infinity grows, the game community will also be of increasing importance. All players should be able to compete by building cars from home, by themselves or in teams, and compete in parallel with the official competitors. This is where we'll find our future students and engineers. One of the main goals of Formula Infinity is to stimulate the interest in technology among children and youth, or as we like to say, future engineers.



LEVEL BASED

From this standpoint, we can see a simple graphical example of how interaction on the starting level of the game could look - a simple swapping of parts. The player would then have the possibility to deepdive in every separate element and interact with it on a more advanced level. For the novice player you can see a guidance system in the shape of an engineering avatar and help information (here in the form of information icons) which is always just one click away. The same rules apply to every level of interaction within the game, but the deeper you dive, the more complex and advanced the information and interaction becomes.

Competition

Formula Infinity will be unique in combining gamified technology education and virtual car construction with a first class racing simulator. This combination will no doubt nonetheless exist in the future, so let's take the chance to lead the development of this technology in favor of education, the technology industry and vehicle sports.

RACING GAMES

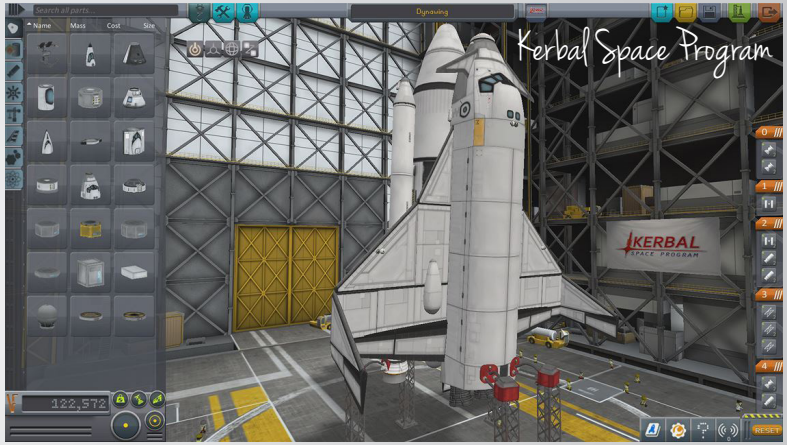
Within the **Sim Racing** genre, there's a multitude of titles competing to be the best simulator for realistic racing. Among those are **RaceRoom, Assetto Corsa, rFactor, DirtRacing**, and more. In these games you can make some general adjustments before a race, but none of the games give you the possibility to actually assemble or greatly modify your car.

CONSTRUCTION GAMES

There are many more engineering type games in different genres. An example would be **Kerbal Space Program**, where you get to build your own rocket and then launch it into orbit or even further on towards the moon or Mars. There are also car mechanic games, such as **Wrench** or **Automation**, where you get to assemble and disassemble car components, however the interaction isn't simulated more than schematically.

CREATIVE GAMES

Other creative games with a more accessible design, such as the Swedish superhit **Minecraft**, have been engaging large young player bases. **Formula Infinity** aspires to build the same type of creative interest for technology.



Uniqueness

AN ENGINEERING ESPORT

There are many racing simulators and engineering games out there, but no game combines these two aspects, and no game digs really deep into the engineering aspect. The racing simulators that exist are getting more and more advanced, and even the automobile industry has started licensing game engines from the genre for use in their internal design processes. These bits of software, however, are not available publicly. So far, no one has created a game where you simulate the actual construction of your car, which takes heavy knowledge in physics and engineering on top of the game development and design competency needed.

The sports of virtual racing also demand a lot from Formula Infinity. It would be especially interesting to build a game versatile enough to handle racing genres and track types that aren't represented in racing simulators today. If we can cover those needs in collaboration with the Swedish Car Sports Association, we are uniquely competitive even within the racing genre.

OPEN LEARNING PLATFORM

Formula Infinity has a unique opportunity to use the interdisciplinary competencies of all the universities involved to build a product with a heavy focus on learning and sparking interest. Another unique possibility is to build this as an open source project, leaving the source code open and available for anyone to build upon and modify; universities, companies, students, enthusiasts and game developers can all use the Formula Infinity-engine to develop simulators, tools or games.

Sustainability

FORMULA INFINITY SUSTAINABILITY GOALS

From the UN global goals

4. Quality Education

Formula Infinity contains free and interactive educational material in the form of a game, spreading knowledge about technology and research within vehicle technology to players of all ages. The academic (and expectedly industrial) initiative is unique in its connection to youth culture and esports.

5.B. Promote empowerment of women through technology

Formula Infinity will be developed out of a gender perspective to make women feel more included in the game environment. The game has a very important task here since it's heavily focused on vehicle technology and sports. A team with the right competencies will lead the work within norm critical design and inclusive content - such as design, sustainability and mathematics, where women have a high representation.

9. Sustainable industry, innovation and infrastructure

Formula Infinity will foster sustainable thinking from the get-go. There will be a special focus on energy effective engines and driving styles, environmentally friendly material and fuel choices as well as sustainable production processes and economical aspects. Every challenge in the game can be framed by sustainability scores - marking your progression through the game.

Use

The Formula Infinity initiative wants to help industry and technology companies as well as academies to be linked to quality and innovation, as well as strengthen brands and goodwill within younger generations, which is notoriously hard to engage.

GENERAL USE

Computer games are a very engaging form of media. Instead of watching movies and series, many young people choose to play games, since they then get to solve problems, create and cooperate. Formula Infinity will make use of this to foster knowledge and engineering interest. The game gives a possibility which has been lost - the possibility to test and play around with technology. In the game, you will be able to build, disassemble and break things, compete with them and share them with friends. We want to create an engineering sandbox which will propel the players into their own technological future. This the general use case for all of our players.

SPECIFIC USE

Through a playful format, the game will create

1. Technical understanding
2. A technical vocabulary
3. Useful skills in a future engineering trade
4. The access to state of the art technology for anyone with a computer

SWEDISH INDUSTRY

Formula Infinity is a project meant to strengthen swedish industry by

- Raising interest for engineering and technology
- Offering an attractive platform for marketing company technology and values
- Facilitating early contact with future engineers for recruiting
- Developing industrial standard digital simulation environments, training environments and testbeds.

This could be made possible by letting each industrial collaborator build its own workshop within the game, where players are given insight into company technology, knowledge and development work. The company will have the chance to share its virtual components for use in the players' vehicle builds. Each component is thought to be accompanied by interactive pedagogical descriptions with physical data and the company logo. These virtual workshops are very important pedagogical environments - meant to help develop swedish technology education.

Target groups

MAIN TARGET GROUPS

The game mainly focuses on opening up an interest in technology to young girls and boys (10 to 15 y.o), as well as developing the interest through high-school and university education. The game should be free to download and work without strong demands on hardware.

The game content should, at entry level, be accessible even to the youngest players, but for every step along the way it should become more advanced. Ultimately, you would be working on an engineering level. We see that this would also be stimulating for the youngest players, as they get to explore something real - just as if they were to take apart a physical engine - that they are curious to one day understand.

SECONDARY TARGET GROUPS

1. Technology teachers at high-schools
2. Engineering teachers at universities
3. Researchers, who want their work to gain visibility
4. Industry and technology companies that want to reach their future employees.
5. People of any age interested in technology

NEEDS

Youth. Children and young people don't know how interesting and fun technology can be, or what their future would be like in an engineering career. This is especially true for girls.

Society. Reversely, it is very hard for society to reach today's youth, as they don't follow behavioural patterns of previous generations. Phenomena such as youtube influencers and gaming communities have become their own worlds and have a large impact on young people.

Universities and industry. Universities and engineering industries are having a hard time finding people with an interest in technology. Today, there are around 75 000 students within technology and natural science educations, but many of these abandon higher level technology studies. We want to reach out to these students and continue to inspire them through the Formula Infinity initiative.

Researchers. Technology researchers need help with making their research visible to the public. Making research available through implementing and explaining it through Formula Infinity would put that research in a context that would show its function and meaning.

Project idea

Purpose

To stimulate youth interest in engineering arts and technology.

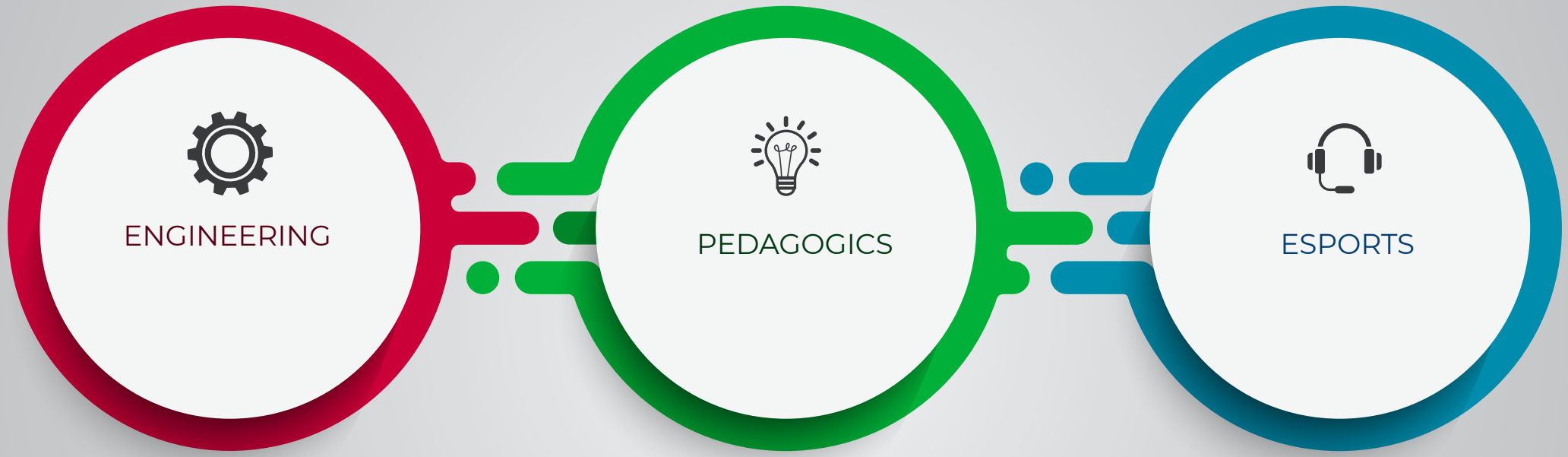
Goal

To build the game and teaching platform Formula Infinity

Method

Cooperation between educational institutions, manufacturers, the business sector and esports organisations.

We will be working within these modules



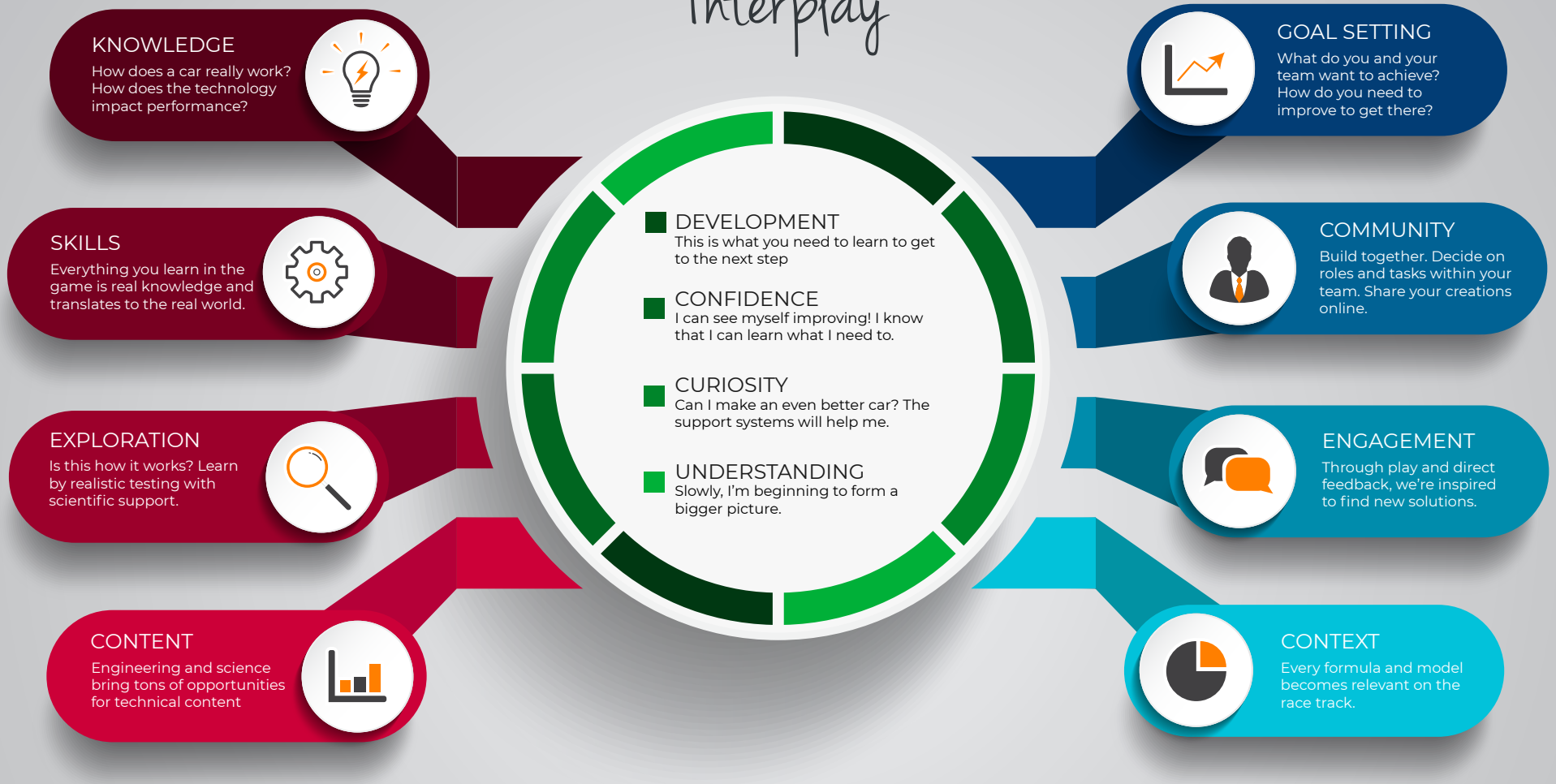
"Game development and modelling of technical components"

"Creating digital learning strategies, storytelling and content"

"Building a competitive scene and a game community"

These modules will further be split into work packages where specialists from academies, the business sector and organisations will work together in interdisciplinary teams. See examples of these work packages on pages 14-16.

Interplay



ENGINEERING

The core of Formula Infinity will consist of engineering. All the content is based on real technology and physics. Every bit of the game will be based on reality-; you can explore how a racecar really works.

PEDAGOGICS

Pedagogics bind engineering and esports together, and envelop the entire project. They lead the player in her development by inspiring curiosity and progressive learning.

ESPORTS

Esports give us structure. Work in teams with dedicated roles, measure your development, compete against others and share your creations within an online community.

COMPUTER SCIENCE

Development of a game engine and a physics engine. Modelling of digital systems within a vehicle. AI implementations for autonomous driving.

ELECTRICAL ENGINEERING AND MECHATRONICS

Modelling of electrical systems, engines and sensors

MACHINE AND VEHICLE TECHNOLOGY

Modelling of everything from machine elements to simulation of subsystems and testing environments, such as aerodynamic tests in wind tunnels.

MATERIALS AND SUSTAINABILITY

Create registers of material properties connected to function and the global sustainability goals.

TECHNICAL DESIGN

Design of game environments and virtual workshops.

CIVIL ENGINEERING

Creating race and test tracks. Developing a map creation tool within the game.

WORK PACKAGES

✔ engineering module

GENDER AND DIVERSITY

Create an inclusive learning environment for everyone

ENGINEERING

Presenting content and explaining aspects of car components, production processes, etc.

TEACHING PROGRESSION

Creating a stimulating progression through the different levels and systems within the game.

HUMAN-COMPUTER INTERACTION

Planning and design of player interaction with the vehicle during construction or during academic educational situations.

NORM CRITICAL DESIGN

Change structural, social, linguistic and graphical norms within technology and engineering.

DIGITAL COOPERATION

Collaborative interaction and creation within a digital space.

WORK PACKAGES

✔ ped. module

COMMUNITY

Developing digital and communication platforms on social media, in community applications and on other online forums.

TEAMWORK

Developing a digital collaborative environment where players can form engineering teams via the game architecture.

ROLE DIVISION

Creating the possibility for players to specialise within their teams. Identify roles and incorporate these in the game.

BROADCASTING FORMATS

Creating inspiring storytelling around the competitive format for Formula Infinity

COMPETITIVE FORMATS

Identifying competitive elements and gamified challenges that stimulate player development and interest.

CONNECTION TO VIRTUAL RACING

Establishing Formula Infinity as one of the existing esports. Leading the way with unique racing genres and formats within Sim Racing.

WORK PACKAGES

✔ esports module

How could a project work?

Formula Infinity aspires to become a gamified educational platform as well as an esport, in collaboration with universities, industry and the Swedish Car Sports Association. Within the term “industry”, we also include the swedish computer game industry. Collaboration can be done as a non-profit organisation, where each member has voting rights.

The work will be split into modules consisting of work packages. During the project, specialists from the academies, the business sector and organisations will be connected to each module and be assigned to interdisciplinary teams with responsibilities within one or more work packages. We will also be involving groups of students for smaller projects and tasks. Preparing for future maintenance of the game is also an important part of the project.

SPECIFICATION

Specification of content and structure

CONTENT

Development of content for each module

GAME

Choice of game engine. Development of the game.

FORMULA INFINITY

Financial Model

RESEARCH AND DEVELOPMENTAL FINANCERS

Supporting swedish technology and industrial competitiveness by

1. Raising interest in engineering and technology among girls and boys.
2. Supporting development of a new digital teaching platform through gamification and esports.
3. Putting swedish universities, engineering and industry on the map.

INDUSTRIAL AND TECHNOLOGY COMPANIES

Investing in future labour force and branding through

1. Raising interest for technical education
2. Meeting and inspiring future workforce
3. Influencing technology education for high-schools and universities.
4. Marketing to customers

UNIVERSITIES AND ACADEMIES

Strategic resources can be used for

1. Raising interest in engineering education
2. Creating an educational environment for use in technology and engineering education.
3. Creating a platform for showcasing research.

Timeline

05
dec

WORKSHOP I

11 universities came together to discuss how engineering can be transformed towards esports.

2020

01
apr

10 universities create this project idea for Formula Infinity.

PROJECT IDEA

apr - aug

BUSINESS SECTOR

The project is introduced to the business sector and they are invited to Workshop II

01
oct

Academies, the business sector and students gather to explore the vision for Formula Infinity.

WORKSHOP II

01
nov

PROJECT PLAN

Development of a project plan, including workgroups and financing.

2021

2021
spring

Together with the industry, we apply for research and development funding.

APPLICATION