Arludo: bringing science and math to students through games

Interview with Michael Kasumovic

Arludo was founded by Michael Kasumovic, an evolutionary biologist, researcher and professor at the University of New South Wales, Australia. It is a bit difficult to define what Arludo is in a single word; broadly put, it is a game studio that also offer educational material and services, and are also great at science outreach. As themselves put it, they are "working to change the way students see and use science in their daily lives." But it all starts with video games.

They already have over 30 mobile games on their portfolio[1] and their new title, *Inglorious Baskers* has just been released on iOS and Android systems. We wanted to know more about this mysterious sciency game studio, so we interviewed Dr. Kasumovic to understand Arludo better and to get a glimpse behind the scenes. Join us and see what we found out.

[1]Take a look at their titles on the App Store or Google Play.

Interview
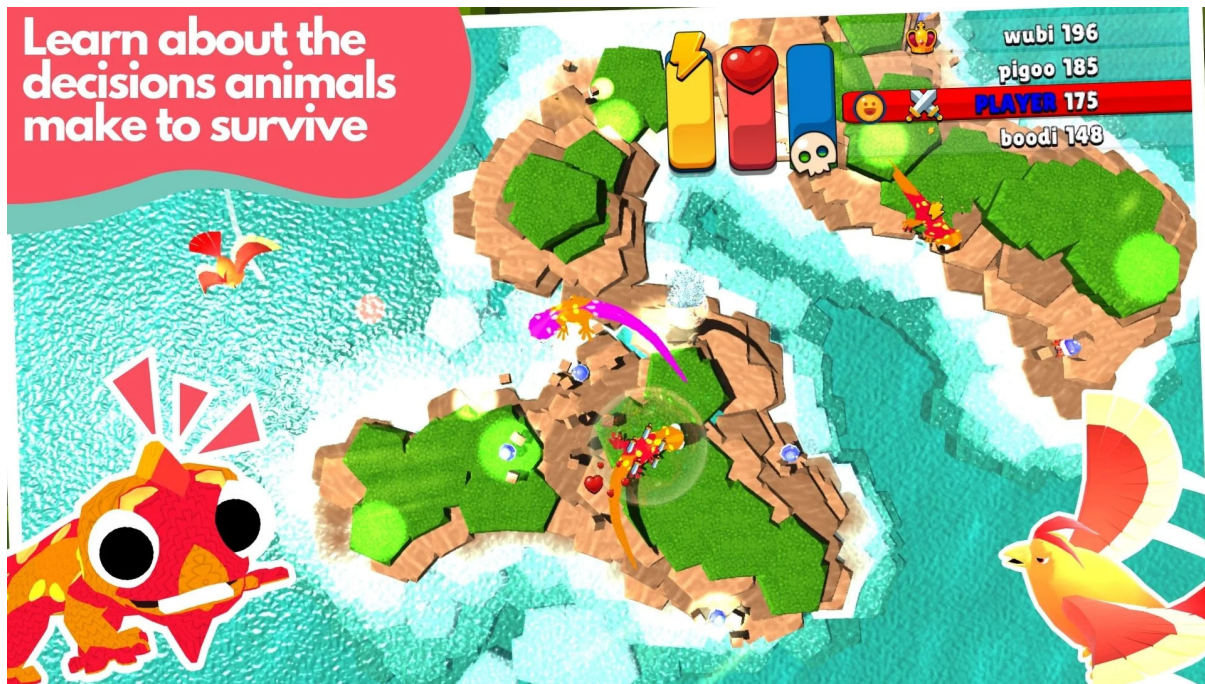
Your new game *Inglorious Baskers* is out now. It is a lizard survival game where the typical tag "survival" in gaming jargon goes well into the territory of ecology. Could you explain what exactly the game is about and what does a lizard need to do to survive?

The game is all about being a lizard! But more seriously, we wanted to create a fun game that provides players an opportunity to understand how animals need to balance different aspects of their lives. Of course, scientists will understand this as life-history theory – how animals use their time and energy to maximise their own fitness.[2] But students generally don't think about these things so don't really understand life-history theory. Additionally, it's hard to collect data that show how animals make trade-offs to maximise their fitness.

That's why we created *Inglorious Baskers*, it was an opportunity to create a survival game where players need to manage the most basic things – getting food, staying away from predators, and for ectotherms,[3] basking in the sun so that your body heats up to allow you to be more active. By playing, students see how difficult it is to manage three simple things. Our goal is that by learning how to balance these three things and seeing these trade-offs occur in the data, students can better understand how animals survive, and how selection can act on this survival to lead to the evolution of different life-history strategies.

What was the inspiration for *Inglorious Baskers*?

It was a conversation with Megan Head![4] Megan is a friend and colleague of mine and wanted to have a game made to explore life-history theory. We chatted a lot and came up with the idea of making it about lizards. Megan has worked on lizards and we haven't had a game using lizards yet, so it was perfect!

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[2] This is evolutionary fitness. Roughly put, it is a measure of an individual's reproductive success.

[3] Ectotherms are animals that depend on external environmental heat sources to control their body temperature.

[4] Dr. Head is an evolutionary biologist working in the Australian National University, Canberra (http://meganl-head.weebly.com/).

How much science have you weaved into the game? And how do you balance the educational part of the game with gameplay and fun?

The game is full of science – we don't hold back! The entire gameplay is based on real research and the behaviour of real animals. There is a lot of research done on lizards, but this one[5] also explored how an individual's basking behaviour is affected by an immune challenge. So we definitely needed to incorporate it! Although the models by which individuals lose energy or heat is not accurate, the concepts are. Sometimes you need to balance learning and fun, because the point is to get a theme across, not that it is exactly based on a specific animal.

But in terms of balancing learning and fun, it's generally easy because we separate them a little. What I mean by that is that the game largely focuses on discovery, and we don't bother students with "learning" when they are trying to figure out the game. Although, that's what they are intuitively doing. We just create a few rules about how things interact, and the let students figure the game out. So for this aspect, we rely more on ensuring the game is fun to play.

The learning part comes after when students explore the data they helped collect by playing the game. Each of our games anonymously collect data as students play. These data can vary from reaction times, to behavioural decisions that players make. But we collect those and display them in real time. This way, students can see the decisions they made at a class level to understand the concepts they were discovering.

This is how we balance the learning in all our games. It's discovery while playing the game, and reinforcement through data that helps solidify the learning afterwards.

You're an evolutionary biologist yourself and an Associate Professor in the University of New South Wales. Are lizards the topic of your research?

Not at all! But it doesn't mean that I don't find them interesting. We try to maximise the diversity of organisms that we use in our games. We've used lizards in *Inglorious Baskers*, birds in *Hungry Birds*, spiders in *Spinder*, and crabs in *Reservoir Crabs*. We usually pick the organism that is studied well for the question that we want to answer.

And when a perfect organism doesn't exist, we make one up! That's what we've done in *Xenon Crowe* and *Cha Cha Island*. The way we move forward in games is really similar to my research – we use the organism that best tells the story. I used to work on birds, but I have done most of my research exploring mate choice and evolution using spiders and crickets. And now my students are working on mites. Researching a variety of organisms keeps it fun!

So let us go back in time for a bit and venture into some origin stories. What led a university professor to start a game studio? How did that happen?

You're making me think back 7 years ago now! I first started thinking about using games when I noticed my students seemed bored using the same kinds of experiments I performed during my undergrad. Then I noticed that students use all this technology in their daily lives, but other than digitising content, the way that students learn hasn't really changed at all. So I thought I would try something really simple using a game system called Aris (which doesn't exist anymore). It allowed you to create a location based game using the GPS in a phone using simple if-then statements.

So, I had some fun and created a mating game where students were spiders and had to find mates and avoid predators in their environment. When I think back at it, I took students out of their classroom and into a

[5] Duran, F.; Boretto, J.M.; Ibargüengoytía, N.R. (2020) Decrease in preferred temperature in response to an immune challenge in lizards from cold environments in Patagonia, Argentina. Journal of Thermal Biology 93: 102706.

Impress the Bower Bird in AR
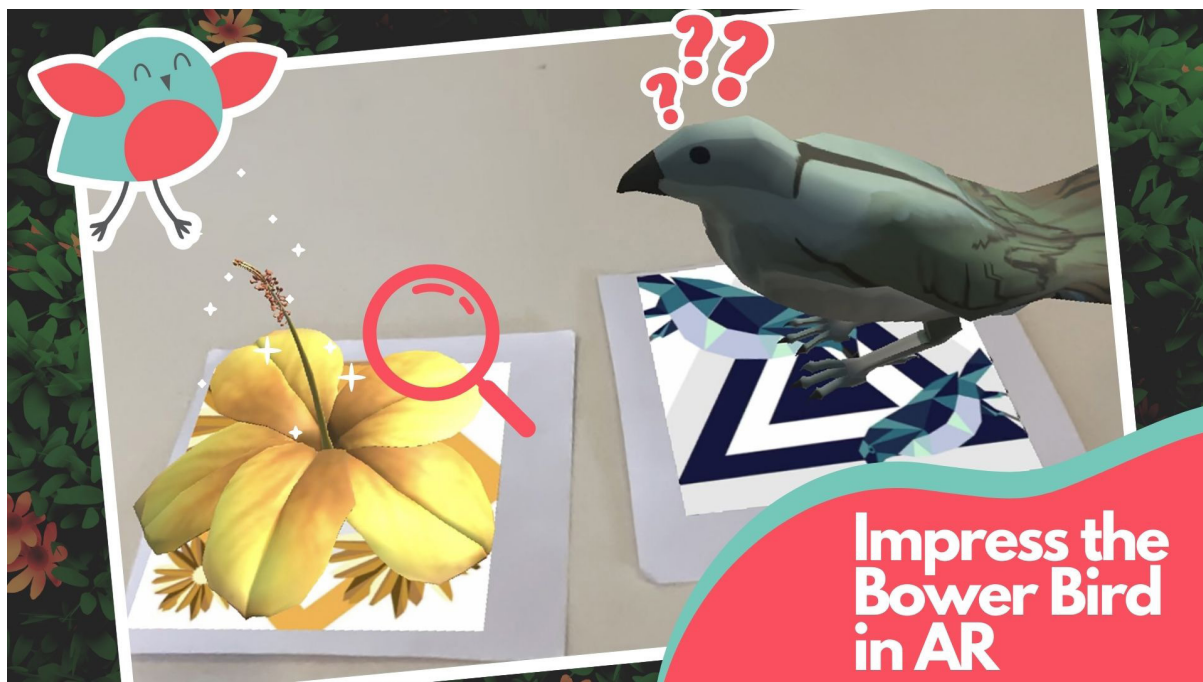
field to make them run around pretending to be spiders. It could have gone so badly! But they had a great time and finished in about 15 minutes (they were exhausted!). We had a phenomenal conversation about the costs associated with mate searching and the different strategies individuals used to maximise their fitness.

This experience changed their perspective and helped them understand these invisible theories they were learning about. It was definitely the most engaging conversation I had in a really long time. It was at that point where I felt I was on to something and I had to give it another go. That's when I hired some student game developers and we made our first few games. Seven years later, some of these folks are still working for me and now we have a really awesome team.

Arludo already has some 30 games in its portfolio. Which ones are your greatest hits or all-time favourites?

Blue Steal is the first game we created, and I still have a warm spot in my heart for it. It's a simple game that uses augmented reality to bring female bower birds to life. Students work in groups that are racing to impress their female using the objects they are given. But what they don't know is that they don't have enough objects to impress her, and that they need to steal objects from other groups.

One of my favourite things is watching the class figure it out. One student from one group hesitantly walks over to another group and they realise that other groups have different objects. Seconds later, this information filters to the rest of the class and chaos ensues! As a lecturer, I see mating strategies 'evolve' in real time – students are stealing objects from one another, others are trading. Some groups begin hording and hiding their items, lying about what they have. It's so much fun talking about the different strategies students used as they speak from experience!

But I do have two other favourites. *Bards & Bandits* is a game that uses the Prisoner's Dilemma to teach students about what affects trust. This was our first multiplayer game and probably why I like it so much. But *Inglorious Baskers* is definitely our most visually exciting game, so I am really proud of what we've built. But we have some great new games coming out which I'm really stoked about. All of this is so much fun!

Besides the games, Arludo also of-

fers courses for parents and students and support for teachers. Could you explain what's on offer and how people can get a hold of it?

We've had different worksheets and programs for students for a while as we've tried to figure out the best way to help students, teachers, and families. All of our offerings can be found at arludo.com. But we're going to be adding so much more very soon!

We're really lucky that we recently received a grant – it's going to allow us to do what I've wanted to do at a scale that would have taken us years. With this new funding, we'll be creating professional development courses that help parents and teachers get up to speed in running and analysing experiments in real time. We're also creating a Discord server full of scientists that students, parents, and teachers can interact with in real time. And these scientists will also run incursions where students can learn and run experiments with them. We're really excited to be able to offer everyone access to scientists in real time so they can all experience exactly what it's like to be a scientist. I think that's what's missing in society – that transparency of what we do which shows how exciting and rewarding science really is.

But one of the things I'm most excited about is the national game design challenge we're running in Australia in 2023. In this challenge, groups of students can submit ideas for a new science game. We'll have a whole learning module to help teachers administer the lessons, and at the end, students will have a new game idea they can submit into the challenge. The top 3 teams win monetary prizes, and the first place team will work with us to bring their game to life. I'm so excited to see what students design!

If everything goes the way we plan next year, then we'll soon be expanding outside of Australia. That being said, we already have users all over the world and anyone can download our games and use our digital worksheets. But our goal is to make science accessible to everyone by translating all our games and worksheets different languages. That'll take some time, but we'll get there!

What has been your experience in classrooms so far? How do people respond to your games and course, be they teachers, students or parents?

It's just a joy seeing students faces when

Create your own experiment

Balance
delicate
ecosystems

they play our games. They are always bit reluctant to start, thinking it will be a 'boring educational game'. But they quickly get into it because we're more about making learning exciting than older educational games. Students start talking to one another. They share tips and commiserate their losses. A whole class really gets into it – even online!

Just like students, parents and teachers are always a bit hesitant to use games to teach – I mean, games are what their kids waste their time on at home! But what they don't realise is that the games we create are actually interactive experiments. In our games, students are scientists discovering the rules of the world we created. As they explore this world, they also collect data that we visualise in real time. This allows students to reinforce what they learned through data. And it also helps them become data literate. Which parent or teacher would not want that?

In your opinion, what makes a science-based or educational game good?

I love videogames. Always have. What makes a game great is the challenge, and the desire to improve to beat that challenge. But to do that, you need to figure out the rules of the game and learn the skills you

need to beat it. To me, this is exactly what science is like.

As scientists, we see a problem that interests us, and we challenge ourselves to understand it. But to understand the problem, we need a certain set of skills to be able to design experiments to allow us to figure out more about how the problem works. So we learn those skills, only to figure out that we need to learn more to figure out new aspects about the problem we didn't know existed initially. It's like a videogame with no ending!

So, what I think makes a great game is the same thing that makes great learning: an engaging task that draws you into wanting to discover more and improve who you are. This is why I think games can be natural teachers. The problem is, most games are created to have fun, and most learning games are created to transfer information (which doesn't work). Realising that you need both aspects – fun and discovery – helps create a feedback loop that leads to real learning. And that's what great games have.

Regarding all those parents and teachers out there curious about this whole science and gaming crossover, what is your

message to them? How can they start down that road?

I have a simple message: learning should be fun.

I realise that our curricula are filled with information that students need to learn to be able to graduate. But I feel that somewhere along the way, we forgot how much fun learning through discovery can be. So we made it facts that students need to memorise. And all the educational technology out there focuses on this idea – how do we get kids to memorize as much as possible.

But this is becoming less and less relevant as technology becomes more advanced. We already have global organisations stating that it's not general knowledge that is the most important aspect, but the learning of skills. But you can't learn skills by just reading or watching something. You learn them by doing. That's why I feel we need to shift how we teach so we can provide students with the skills they need for their future careers.

And how do they start? Come visit us! Just download any one of our games and give it a try – they are all free and there is nothing for you to prepare. You don't even need to make a lesson out of it. Just let your students play for 15 minutes and have a conversation about what they did and why. You'll quickly see how much they learned, and most importantly, how much fun they had doing it. Once your convinced, you can try a lesson.

But pretty soon, we'll have dozens of free videos with amazing science communicators on YouTube. Each of these will give students an idea of what is possible through science and the diverse careers science can lead to. It's going to be exciting!

And what about all the students whose interest in science might be sparked by a game? How can they keep that interest alive?

They should join our Discord server! I'm not kidding. This is exactly the problem that we are trying to solve: students that get interested by something about science often have no one to talk to and don't know where to go to find out more information about that topic. So their interest just wanes and disappears. As parents and teachers, we've missed this great opportunity to excite them about learning.

Our Discord server will have scientists that can act as mentors to help direct students towards better learning pathways. What I love about what we're creating is that these opportunities to meet scientists were limited to people that live in cities with parents that know academics. We're changing that so any student anywhere will be able to chat with a scientist – no matter if you're living on a farm in Western NSW or on a small island of the coast of Australia, we'll have someone kids can chat with to excite them about what is happening in the world around them.

STAGE TWO

Females love males with dark tails! Select for dark-tailed spiders.
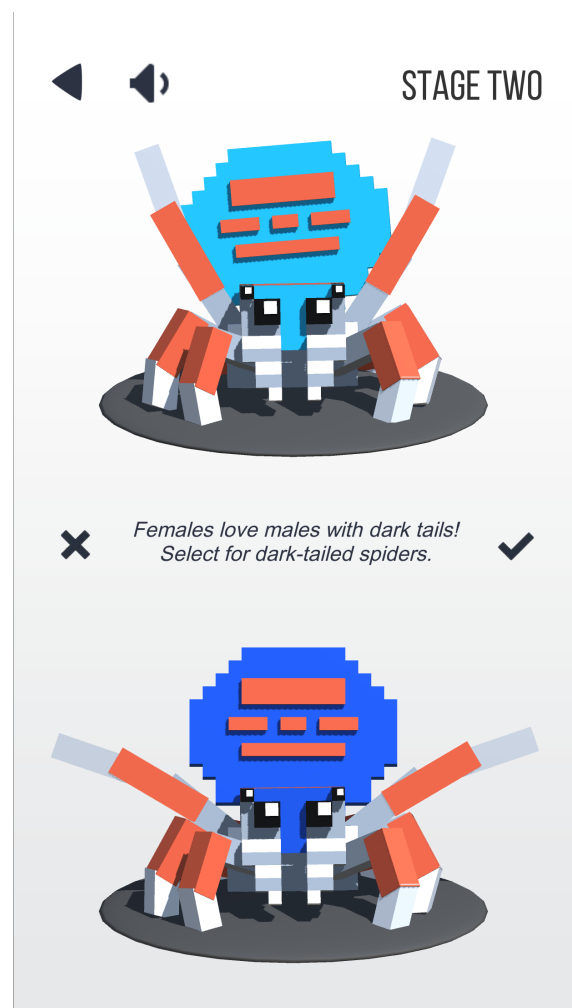
About the Team

    Arludo is a team of scientists, educators, game designers, programmers, videographers, animators and artists creating a way for people to interact with science in the most engaging way possible. They've created 30 different games with worksheets that teach biology, psychology, maths, and soon, entrepreneurship and game design! They've even had a really successful science show on Twitch – #BatteryLow – where they had over 150,000 join them to play videogames with scientists online. They'll have some incredible initiatives coming soon, so follow them on [Twitter](#), [Instagram](#), [TikTok](#), and [YouTube](#). And don't forget to join their [Discord Server](#) too!