

**School of Computer Science and Statistics**

**Individual Assessment Submission Form**

|  |  |
| --- | --- |
| **Course Title** | TEP |
| **Module Title** | TEP 00062 |
| **Lecturer(s)** | Prof Dave Lewis, Prof Vincent Wade |
| **Assessment Title** | Individual Assignment on Ethical Digital Engagement |
| **Date Submitted** | 31/03/24 |
| **Word Count** |  |
| **Student Number** | 21363767 |
| **Student Name** | Jonathan Hall |

**Assignment Submission Declaration:**

I have read and understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: <http://www.tcd.ie/calendar>

I have also completed the Online Tutorial on avoiding plagiarism ‘Ready, Steady, write’, located at <http://tcd-ie.libguides.com/plagiarism/ready-steady-write>

I declare that this assignment, together with any supporting artefact is offered for assessment as our original and unaided work, except in so far as any advice and/or assistance from any other named person in preparing it and any reference material used are duly and appropriately acknowledged.

Any use of Chatbots/Generative A.I. tools in researching the materials research for this report is fully described at the end of the report. I confirm that no text produced by such tools has been directly used in the report.

Signed ……Jonathan Hall…… Date ………30/03/24………………

Description of use of Chatbots/Generative A.I. tools:

………………………………………………………………

In the digital age, applications utilising artificial intelligence (A.I.) to enhance user engagement are becoming increasingly prevalent. One such application, Duolingo, exemplifies how A.I.-driven techniques can revolutionize language learning. This essay explores Duolingo's application, identifies the roles of various stakeholders involved, assesses potential ethical risks, and discusses mitigation measures to address these risks.

Duolingo is a language-based learning application that has re-invented the way in which people learn languages. It was invented by Luis von Ahn and his PhD student Severin Hacker in 2011, out of the Carnegie Mellon University, Pittsburgh, Pennsylvania, United States. Duolingo offers over 45 different languages currently, whilst also offering Math and Music lessons too (Blanco, 2022).

With over 500 million registered users, it is one of the most popular education apps in the world. Its goal is “to develop the best education in the world and make it universally available” - (Duolingo Support, 2022). It achieves this by offering a user-friendly experience, gamification of learning and personalised learning experience powered by artificial intelligence.

Duolingo’s business is based on a Freemium model, much like other large platforms such as Spotify. The user can use the app for free with a few advertisements, or they can pay for additional features alongside the removal of ads. The app breaks the languages into small 2-minute-long lessons, that cover a vast range of topics from basic vocabulary to complex translation of dialogues. The user can progress through the lessons at their own pace. If the topic is too simple for you, you can even take a small test to skip to the next topic. Users earn XP (experience points), unlock new levels that increase in difficulty, operating on a 5-life system (5 mistakes can be made) gamifies the studying experience and allows friends to compete. Through gamification Duolingo can keep users engaged and motivated to continue learning every day.

A.I. plays a large role in the success of Duolingo. Algorithms are employed to customise the learning experience for each user. By analysing a user’s performance on their lessons, the system can identify their strong and weak points, and adjusting the difficulty of lessons accordingly. This approach keeps the level of difficulty appropriate to the user, ensuring no lesson is too difficult or too easy, keeping the user in a goldilocks zone. Duolingo utilizes A.I. to space the content for revision as well, maximizing the user’s ability to retain the vocabulary.

The ecosystem around Duolingo involves a diverse array of stakeholders, each playing a crucial role in the application's development, use, and governance. These stakeholders include developers, users (learners), language experts, investors, educational institutions, and even governments, all of whom derive specific benefits from their involvement with the application.

The developers and engineers who design, build, and maintain the application. This group includes software engineers, data scientists, and A.I. specialists who work directly for Duolingo Inc., the organisation behind the app. Their role is instrumental in implementing A.I. technologies and ensuring the platform remains engaging, effective, and user-friendly. The benefit to these stakeholders is professional development and compensation, as well as the fulfilment that comes from contributing to a globally impactful educational tool.

Users of Duolingo, are perhaps the most direct stakeholders. They use the app to learn new languages, improve their skills, and engage with different cultures. The benefit for users is the acquisition of valuable language skills at no or low cost, enhanced employability, and personal enrichment. The users as stakeholders are the source of data that the A.I. program is collecting. Collecting various data points related to their lessons, is gathered to help improve the difficulty of the lesson and the user’s overall progress.

Linguists and language educators contribute to the development of course content, ensuring that linguistic information is accurate and is following good methods of teaching. While some of these experts may be in-house, Duolingo also collaborates with universities and language institutes. The benefit to these stakeholders includes professional recognition, research opportunities, and the chance to influence how languages are taught on a massive scale. Linguistics interact with the A.I. program to make sure the lessons are correct, and to help provide cultural context, even though A.I. is a powerful tool, it has shortcomings in the areas of human interpretation and cultural influences.

Venture capitalists and shareholders who invest in Duolingo Inc. are crucial for providing the financial resources needed for research, development, and expansion. Their benefit is financial return on investment, particularly as Duolingo continues to grow and potentially increases its market value. The shareholders’ investment would’ve enabled Duolingo to acquire the necessary finances to obtain successful A.I resources, as they can have a large initial cost, however the use of A.I. in Duolingo has given it the cutting edge against competitors as it can output lessons at a rapid pace.

Schools and universities increasingly incorporate Duolingo into their curricula as a supplementary tool for language learning. Many teachers implement the classroom function into their methods of teaching a language. In the classroom section on Duolingo a teacher can create a class, where which they can view the progress for each student. This collection of data is completed by A.I., and it enables the teacher to identify the weak points of a student’s vocabulary, enabling the teachers to create specialised learning plans for each student. The seamless integration of A.I into the classroom via Duolingo, has helped revolutionise the way in which languages have been used in the classroom.

The tourism industry and businesses who trade internationally indirectly benefit from Duolingo. The increase in multilingual people in a community boosts tourism and international business trading as it helps bridge the gap, the language barrier between locals and international people visiting. International communities also indirectly benefit from Duolingo, due to the education of a language may spark interest into someone wanting to learn more about a countries culture, i.e. trying out different cuisines in restaurants.

The governance and development of Duolingo involve a complex network of stakeholders, each contributing/ receiving unique benefits to/from the application. This collaborative ecosystem not only fuels the app's continuous improvement and expansion but also amplifies its impact on global language education.

Human Rights

Privacy and Data Protection

Human Rights has been the centre of ethical practices for many years and with the digital age there is no change. It comes in the form of Privacy and Data Protection of the user. Our personal information is valuable by many companies who use targeted ads. For this reason, privacy and data protection is of utmost importance, to protect users from harmful content. There is a high risk in this section as Duolingo collects a large range of data from their users. Some articles even dubbing Duolingo as, ‘The Champion of Tracking,’ this is due to it collecting almost 4x the average amount of data points compared to its competitors (Lapientye, 2023). This data is used to create more personalised lessons for a more enjoyable experience however this data must be stored. Duolingo on their support page have stated they do not sell your data (Duolingo Support, 2024), but data has been leaked through hackers before, with approximately 2.6 million users’ data been sold to phishing companies (Mascellino, 2023). Whilst the impact is rated high, there is only a medium level risk associated as Duolingo employs strict security measures and is constantly investing in its cybersecurity.

Duolingo operates on an inclusive principle of providing education of languages to all who seek it (Duolingo, 2021). Here they enable people to practice their right to education, as Duolingo offers their educational services for free.

Labour Practices

The tech industry is known for its demanding work culture, which may lead to burnout and dissatisfaction of employees. There is a medium level impact on labour practices for employees, as they are susceptible to burn out. There is not a significant amount of information available online for their labour practices, however due to their competitive positioning in the language education market, it would suggest the company is also keeping up with their competitors in this section too.

The rise of freelance workers in the tech industry has brought many opportunities for work at companies such as Duolingo, with ‘Glassdoor’ suggesting a freelance translator would be paid up to 45 thousand dollar per annum (N.D., 2021). Even though freelance culture has been seen to improve flexibility, job security is not the same. The freelance workers are not considered employees, but more so contractors.

Carbon Footprint of A.I. Training

A.I. and machine learning, integral to Duolingo’s adaptive learning model, require significant computational power, contributing to the company’s carbon footprint. This risk, with a medium impact and high likelihood, affects all stakeholders involved due to the broader environmental implications of global warming. By optimizing data centre efficiency through investing into newer technology that can utilise power more efficiently, using renewable energy sources, and investing in carbon offset projects, Duolingo can work towards reducing its carbon impact potentially becoming a carbon neutral company. In their company report to the shareholders in 2023, Duolingo had reported of offsetting carbon through (Terrapass) 2022 and Pachama (2023), they had also reported a donation of 8000lbs of food that would’ve spoiled in 2022, aiming to reduce their waste and carbon output (Von Ahn, 2023).

Fair Operating Procedures

Intellectual Property Rights

Developing language courses that respect intellectual property rights is crucial, especially for less common languages or specific cultural content. The risk of infringing upon \*\*Language Experts and Cultural Groups\*\*’ intellectual property is low in both impact and likelihood, given Duolingo’s reliance on licensed content and public domain resources. Continued diligence in content sourcing and collaboration with cultural representatives is key to avoiding potential infringements.

Transparency in Algorithms

The algorithms that adapt learning paths for users are central to Duolingo’s success but also a source of potential ethical concern. The impact on Users is low, given the primarily educational context, but the medium likelihood of concern arises from increasing demands for algorithmic transparency across tech platforms. Enhancing transparency regarding how learning paths are determined could bolster user trust and facilitate more personalized learning experiences.

Consumer Issues

Accessibility

Ensuring the Duolingo app and website are accessible to individuals with disabilities is not just a legal requirement but an ethical obligation. The high impact on Users with Disabilities reflects the significance of accessibility in enabling equitable learning opportunities. The risk likelihood is low, thanks to Duolingo’s ongoing efforts to meet and exceed accessibility standards, yet continuous improvement and user feedback are vital to ensure accessibility remains a priority. Duolingo ensures they accommodate disabilities by allowing the user to submit an extra accommodation form, flagging the account to be in receipt of different accommodation, like extra time per question (N.D., 2024).

Accuracy and Effectiveness of Learning Material

The possibility for misinformation or ineffective teaching methods presents a medium impact and likelihood risk to users. Inaccurate or culturally insensitive content can undermine learning outcomes and user trust. Engaging language experts and continuously updating content based on the latest development in teaching practices and user feedback can mitigate this risk, ensuring that Duolingo remains a reliable and effective tool for language learners.

Cultural Sensitivity and Representation

Duolingo’s broad language offering includes courses in endangered or minority languages, highlighting the platform's role in cultural preservation. However, the medium impact and likelihood of inadequately representing the cultural diversity within these languages pose a risk to users and cultural groups. Collaborating with native speakers and cultural experts in course development is essential to ensure content is culturally sensitive and inclusive. Through their relentless work alongside the native speakers, Duolingo is helping revive certain languages, for example ever since Irish has been added to Duolingo, there a been an increase of speakers leading to Ireland’s president publicly thanking the company’s involvement with the local language (Wen, 2019).

Economic Impact on Traditional Education Providers

The disruption caused by Duolingo’s free model can have significant economic implications for traditional language schools and educators, marked by a high impact and medium likelihood. Language learning institutions may see a decline in participation for paid courses as learners opt for Duolingo’s free alternative. However, I believe this is more likely to be of lower impact, as Duolingo is not meant to be a replacement for classes but more as a supplementary tool to learn the language. Transforming this challenge into an opportunity involves Duolingo partnering with educational institutions to supplement traditional teaching methods, as previously mentioned through the Duolingo classroom function.

In addressing these ethical risks, Duolingo must navigate a complex landscape of stakeholder interests, technological challenges, and social responsibilities. Proactive measures, including robust privacy protections, fair labour practices, environmental sustainability efforts, and continuous engagement with the educational community, are essential. By maintaining high ethical standards, Duolingo can continue to advance its mission of making language learning accessible and enjoyable for all.

The ethical issue of most in importance in the analysis of Duolingo’s landscape is the privacy and data protection of users. This risk holds significant implications due to the high sensitivity of personal information and the potential consequences of data breaches. The mitigation of this risk involves comprehensive measures that address both the likelihood and impact of data privacy and security incidents. The stakeholders involved in these measures include Duolingo, Users, Regulators, and potentially Third-party Security Experts. The implementation of these measures can be both an internal governance action by Duolingo and a collaborative effort with external parties.

Mitigation Measures

Safeguarding of user data and privacy is of utmost importance for applications like Duolingo, which gather significant amount of personal information to provide educational services. The effectiveness of Duolingo's data protection strategies relies on a comprehensive approach that interlinks technological innovations, adherence to legal standards, and active user participation.

Duolingo's approach to keeping user data safe is built on several key strategies that work together to protect against unauthorised access and data breaches. At the heart of these strategies is the use of advanced encryption techniques. This means that Duolingo makes sure any data it stores or sends is coded in such a way that only authorised people can read it. If someone tries to hack this data, they won't be able to understand it. This step greatly reduces the danger of data breaches by making stolen data almost worthless to thieves. Developers and security experts from outside the company play a vital role in setting up and managing these encryption methods, highlighting the need for skilled professionals and external checks to keep data safe. These encryption methods are tested regularly through penetration tests from third party companies, to ensure they are working and to a high standard (Baig, 2023).

To strengthen its defences even further, Duolingo regularly checks its systems for weaknesses that hackers could take advantage of and amends these issues right away. The teamwork between Duolingo's in-house developers and external security experts is essential. External security brings an unbiased view that helps find and solve security problems more effectively. This careful checking and fixing of vulnerabilities make it much harder for hackers to break in.

Being open about how user data is used is crucial for building trust and following the rules. Duolingo is committed to making its data use policies easy to understand and making sure users agree to how their data is collected, used, and shared. This transparency not only keeps users informed but also gets them involved in the privacy process, with the legal team, management, and users themselves all playing significant roles.

Keeping in line with international data protection laws, like the GDPR in Europe and the CCPA in California, is key part of Duolingo's privacy strategy. This compliance helps Duolingo meet strict privacy standards, avoiding legal and financial issues. The legal team, regulatory authorities, and management work together to ensure Duolingo's operations stay within these laws, protecting user privacy.

Teaching users about data privacy and security is also vital. Duolingo gives users the tools and information they need to keep their personal information safe. This effort shows how both users and developers share the responsibility for data protection.

Having an up-to-date plan for responding to data breaches is essential. This plan means Duolingo can quickly deal with any data breaches, reducing harm and quickly rebuilding users' trust. Management, developers, the legal team, and external security experts all contribute to this plan, showing the importance of teamwork in responding to data breaches.

In conclusion, Duolingo's integration of A.I. into language learning highlights the transformative potential of technology in education. By tailoring lessons to individual user needs, gamifying the learning experience, and providing accessible education to millions worldwide, Duolingo has redefined the approach to language acquisition. The application operates within a complex ecosystem involving a diverse group of stakeholders, including developers, users, educational institutions, and investors, each contributing to and benefiting from Duolingo's success.

However, the deployment of A.I. and the collection of vast amounts of user data introduce significant ethical considerations, particularly regarding privacy and data protection. The potential risks associated with these practices, including data breaches, the carbon footprint of A.I. training, labour practices, and the impact on traditional education providers, require a proactive approach towards its mitigation.

Duolingo's efforts to safeguard user data through encryption, regular security audits, transparent data use policies, compliance with international data protection laws, user education on privacy, and a robust incident response plan illustrate a commitment to addressing these ethical concerns. By continuously evaluating and improving these measures, Duolingo not only enhances the security and privacy of its platform but also sets a precedent for ethical responsibility in the tech industry.

As Duolingo continues to innovate and expand its offerings, the application's ability to adapt to ethical considerations will be crucial in sustaining its mission to make high-quality education universally available. The intersection of technology, education, and ethical responsibility in Duolingo's model provides valuable insights into the potential for A.I. to enhance learning experiences while highlighting the and responsibility in managing the accompanying challenges.

Reference:

Blanco, C. (2022) Duolingo 101: How to learn a language on duolingo, Duolingo Blog. Available at: https://blog.duolingo.com/duolingo-101-how-to-learn-a-language-on-duolingo/#:~:text=We%20offer%20courses%20in%2045,education%20possible%2C%20all%20for%20free. (Accessed: 31 March 2024).

Duolingo (ed.) (2021) About Us, University Programs Duolingo. Available at: https://university.duolingo.com/our-story-1 (Accessed: 30 March 2024).

Duolingo Support (2022) What is duolingo?, Duolingo Support. Available at: https://support.duolingo.com/hc/en-us/articles/204829090-What-is-Duolingo (Accessed: 31 March 2024).

Duolingo Support (ed.) (2024) Data Privacy & Duolingo: Welcome to the duolingo data vault – ..., Duolingo Support. Available at: https://support.duolingo.com/hc/en-us/articles/360004256711-Data-Privacy-Duolingo-Welcome-to-the-Duolingo-Data-Vault (Accessed: 30 March 2024).

Lapientye, J. (ed.) (2023) Duolingo crowned as “Undisputed champion of tracking”, Cybernews. Available at: https://cybernews.com/news/duolingo-champion-of-tracking (Accessed: 30 March 2024).

Mascellino, A. (2023) Data of 2.6M duolingo users leaked on Hacking Forum, Infosecurity Magazine. Available at: https://www.infosecurity-magazine.com/news/data-26m-duolingo-users-leaked/ (Accessed: 30 March 2024).

N.D. (2021) Duolingo Freelance Translator Salaries, Glassdoor. Available at: https://www.glassdoor.ie/Salary/Duolingo-Freelance-Translator-Salaries-E629348\_D\_KO9,29.htm.

N.D. (2024) Duolingo English test, Duolingo English Test. Available at: https://englishtest.duolingo.com/test\_takers/accommodations (Accessed: 31 March 2024).

Von Ahn, L. (ed.) (2023) Form DEF 14A for Duolingo Inc filed 04/28/2023, Proxy Statement Pursuant to Section 14(a) of the Securities Exchange Act of 1934. Available at: https://investors.duolingo.com/static-files/f0e6a687-e63a-40b2-8bdf-4eb3d727e8db (Accessed: 30 March 2024).

Wen, A. (2019) Duolingo preserves endangered languages, Business Today Online Journal. Available at: https://journal.businesstoday.org/bt-online/2019/duolingo-preserves-endangered-languages (Accessed: 31 March 2024).