GMIT Teaching and Learning

GMIT Teaching and Learning Impact Case-Study Template

Section A	
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T&L Area	School of Science
Title of Project Case Study	Power App for Interactivity in Maths

Case Study Summary (Maximum 750 words)

Please provide a "web-friendly" summary of the case study impact here.

1. What we did /how we did it

This project explored the potential of Microsoft Power Apps to connect, engage and support learners in maths. The app offers an interactive interface which enables first year students to access the suite of Maths learning spaces and tools from their phone or computer in the first six weeks of college life. A major benefit is how the app embeds within the students Maths Team space for easy access.

2. Outputs and impact Achieved

The app was co-developed with students and focuses on a suite of key maths learning spaces and technologies to help transition to students to college life. The app introduces the learner to the Maths lecturing team and shares students' video and word cloud of past learning experiences. Tools such as track my progress allows students to track and predict their progress in the module. The app links the learner to learning spaces including Live Lectures and tutorial sessions (Teams), Interactive Notes (OneNote Classroom), Assessments (Moodle Quizzes and Assignments) and additional Help (Maths Learning Centre) as well the opportunity to Book a Group or 1 to 1 slot with the maths Lecturing Team.

The app focuses on interactivity and ease of access for the following learning spaces.

1. **Interactive assessment tracker app** (progress checker). Students can make sense of assessments scores and how this contribute to overall success in the maths module.
2. **Interactive Notes:** links to OneNote classroom which provides interactive self-paced learning using embedded GeoGebra, Replit IDE, Microbit and Forms and for interactive questions and solutions. The real untapped potential however is the automatic generation of practice questions based on a single question. This outputs an instant Quiz which embeds in OneNote. GMIT students enrolled in the OneNote Classroom can access this on their phones with no additional sign-in.
3. **Interactive Learning Spaces:** Calendar with live lecture and tutorial sessions join buttons. In class interactivity is promoted linking to Slido app which is embedded within Teams. An additional Power Meeting App template is available for lecturers to extract lecture Teams meeting details to OneNote capturing attendance and follow up tasks to Microsoft planner).

3. What we learned

This project sought to explore the potential of Power Apps to harness interactivity and engagement with first year maths students. The following learnings were captured.

- There is an extensive collection of interactive tools and technologies for maths learners. Many of these are free and useful to engage learners however the different locations within Teams, Moodle, OneNote, replt.it, geogebra, Slido, booking, forms can lead to technology overload and confusion in the early weeks of college life. Using a Power App all the technologies are brought to a single access point which can be downloaded on the student's phone, computer or embedded within their module Team site.

- Interactive self-paced feedback is critical in learning maths offering students the space to make mistakes and retrieve and practice questions which leads to mastery of a concept. Many of the technologies can be integrated and embedded within Microsoft environment, however the limiting factor is the knowledge of the connectors and how to harness the full potential of tools. For example; geogebra and replt.it embeds within OneNote enable learners to interact with maths visually and test their understanding with question and solution check questions.

- To utilise the full potential and give students a personalised welcome, and timetable would require an upgrade on the student Microsoft licence. For example, to avail of dashboard of personalised results the Microsoft licence would need to be upgraded to include row level permissions within Power BI.

Section B

1. Context/Rationale (Maximum 500 words)

This section should provide:

- *A clear rationale for the initiative described and its significance.*
- *Brief details of any research that has provided key insights or findings that has informed the development of the initiative and who undertook this research.*

Practise and retrieval at different and increasing spaced intervals of time is a simple yet effective learning strategy which creates strong neuropathways, encourages mastery and long-term memory. Retrieval practice can help with both fact-based learning and learning transfer (Smith et al., 2016). During retrieval practice with feedback the brain develops neural pathways over time via myelination. Enabling learners to make choices and offering opportunities to make mistakes increases electrical brain signal through conscious attention and awareness that an error has been made. Timed practice and feedback can thickenthe myelin required for strong neural pathways. Some of the concerns with traditional approaches are that passive lectures or repetitive reading produces little evidence of meaningful learning (Callender & McDaniel, 2009) and can in fact lead to higher failure rates than active lectures in science subjects (Freeman et al.,2014). This proposal seeks to develop a power app which encourages active in lecture learning and out of class interactive note reading which reduces cognitive overloading through retrieval

practise and feedback opportunities.

Approximately 500 first year learners undertake maths in GMIT Science and Computing programmes. Many are in large group lectures. Currently tools such as Kahoot and Turning Technology are used to engage learners in lectures, provide feedback and interactive practice opportunities. The project built on research conducted in the School of Science and Computing from 2015-2019 which illustrated that learners enjoy active learning environments. The limitations of the current practices are that these external tools used by lecturers are not accessible to learners after class or embedded within their learning space.

This proposal explored the potential of developing a power app which maximizes practice and retrieval opportunities for learners both in and out of class. The app harnesses the potential of Microsoft tools which the college has already licences for such as Power App, MS OneNote classroom. Currently OneNote will automatically replay in-class notes as they were written during the lecture, translate to multiple languages and guide the lecturer on the best format for accessibility for diverse learner sets.

This proposal explored the potential of this technology through the development of a power app which

- Transition learners to college technologies having a one stop shop app that connects the suits of learning tools such as Teams, Moodle, OneNote.
- Introduce the learners to the maths team and hear past students experiences of learning the module.
- Clearly map and outline the assessment types, deadlines and weighting. Students can use the track my grade app to explore the value of assessment activities and they contribute to their final mark.
- Harness the interactive power of OneNote classroom and enable learners to make choices, mistakes, and offer feedback to encourage further effort
- In class interactivity can be aligned with lecture questions embedded within the interactive lecture notes with immediate feedback to develop mastery.
- Engage learners **in** large groups with immediate feedback on questions using mobile technology and seamless sign in.
- Capture and dashboard class understanding of concepts to allow for conceptual change and difficult concepts to be reinforced in lectures

2. Details of Outputs and Impact (Maximum 1000 words)

This section should provide a narrative, with supporting evidence, to explain the nature and extent of the outputs and impact (include screenshots, if relevant).

This power app interfaces and integrate tools already in use in GMIT. The ease of learner and lecturer access and use gives the project scalable institute wide potential. Below are some screens shots of outputs. The homepage welcomes the students with encouragement and outlines how to use the app as presented in figure 1.

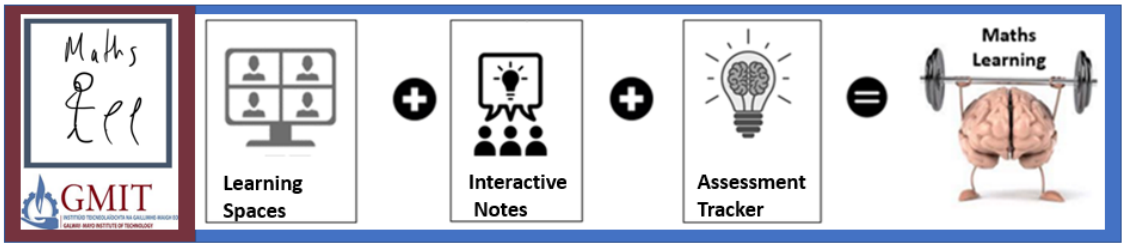

Figure 1. Home page linking the key components of the site.

To introduce students to the Maths team in a friendly way each of the lecturers has made a welcome video introducing themselves, their interests, their philosophy on learning. This is presented in Figure 2.

Figure 2: Meet the Maths Team and Past Students

Students also share their experiences of learning maths, four students from diverse cultural and maturity backgrounds explain how they succeeded in maths. A word cloud of "advice students would give first years starting in September" is shared. This has been collected over 5 years.

The essence of the tool is to connect students to the myriad of maths learning spaces shown in Figure 3. The app explains each of the learning spaces and connects students directly to the spaces such as the live lecture, recorded live lectures, question and answer sessions, pre-recorded "how to videos". It directly links the students to the quiz and assessments within Moodle pages.

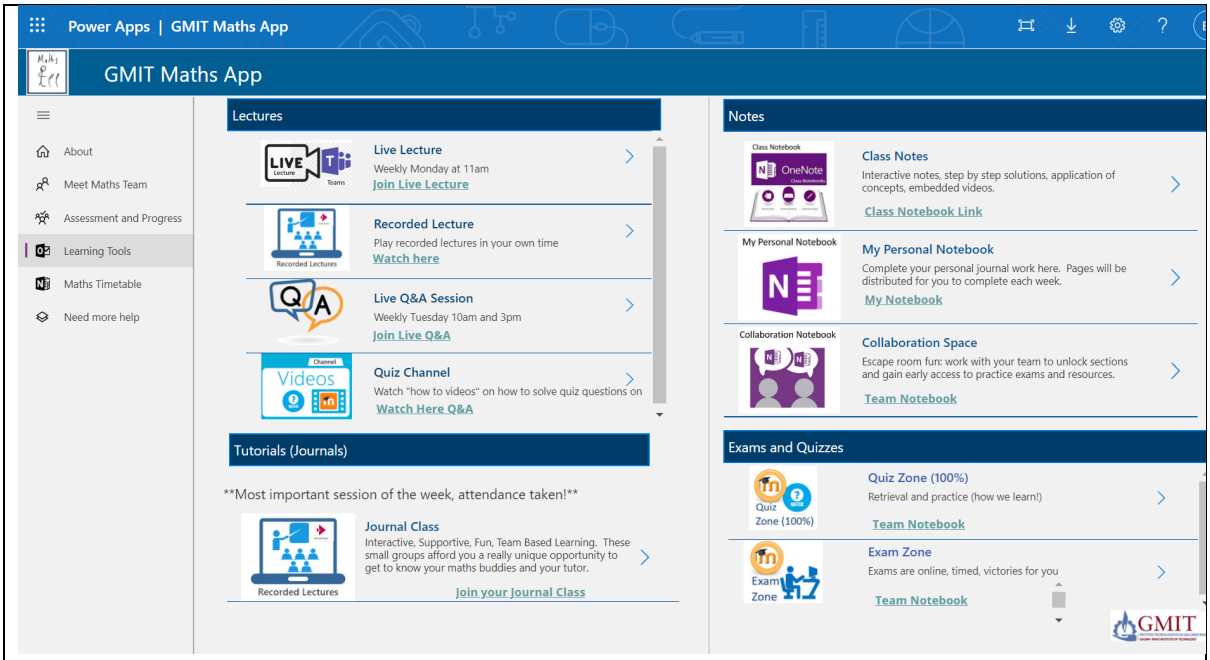

Figure 3: Learning Spaces and Tools

A demonstration of the interactive dimensions of OneNote are showcased as the primary self-paced maths online learning space. Figure 4 illustrates how GeoGebra embeds in OneNote with hundreds of free visuals. For example, a student can manipulate the coordinates and find the modulus and argument on an argand plane. For more examples of free Geogebra resources click here.

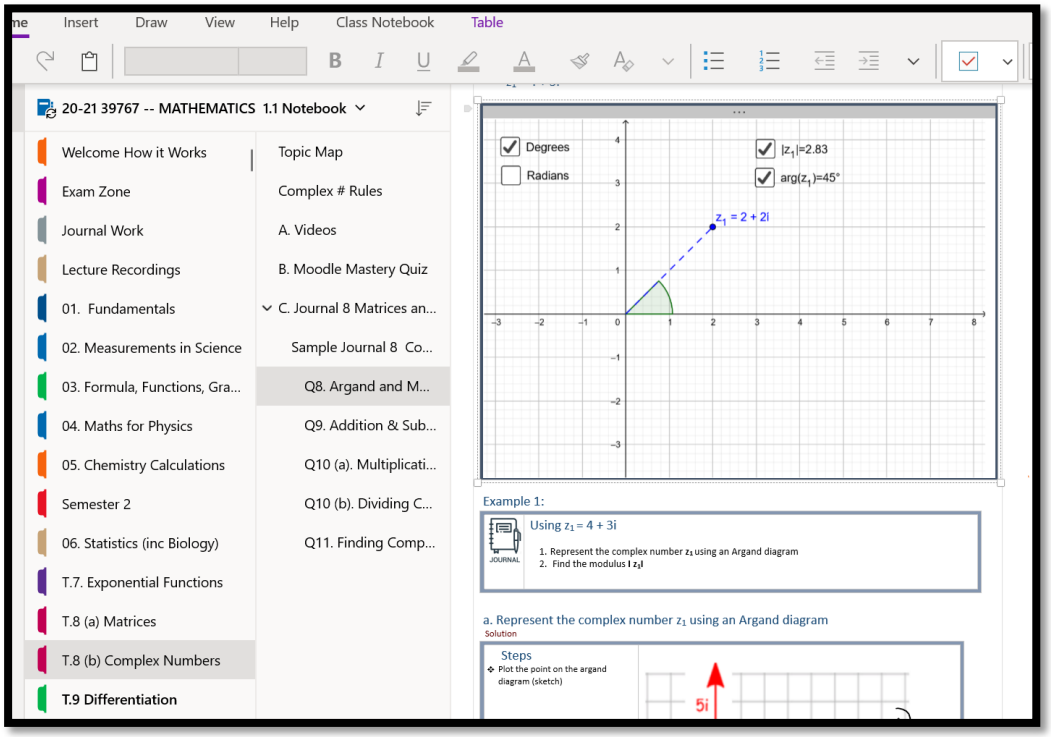

Figure 4. Embedded GeoGebra interactive visual within OneNote classroom notes.

The computing students really benefit from the Repl.it IDE which embeds directly into OneNote. In the example illustrated in Figure 5 the students were able to write code to simulate Boolean

logic for a Clean Room Scenario. Each of the students can then run and test the code within the OneNote notebook. Examples of a student's contributions are presented here.

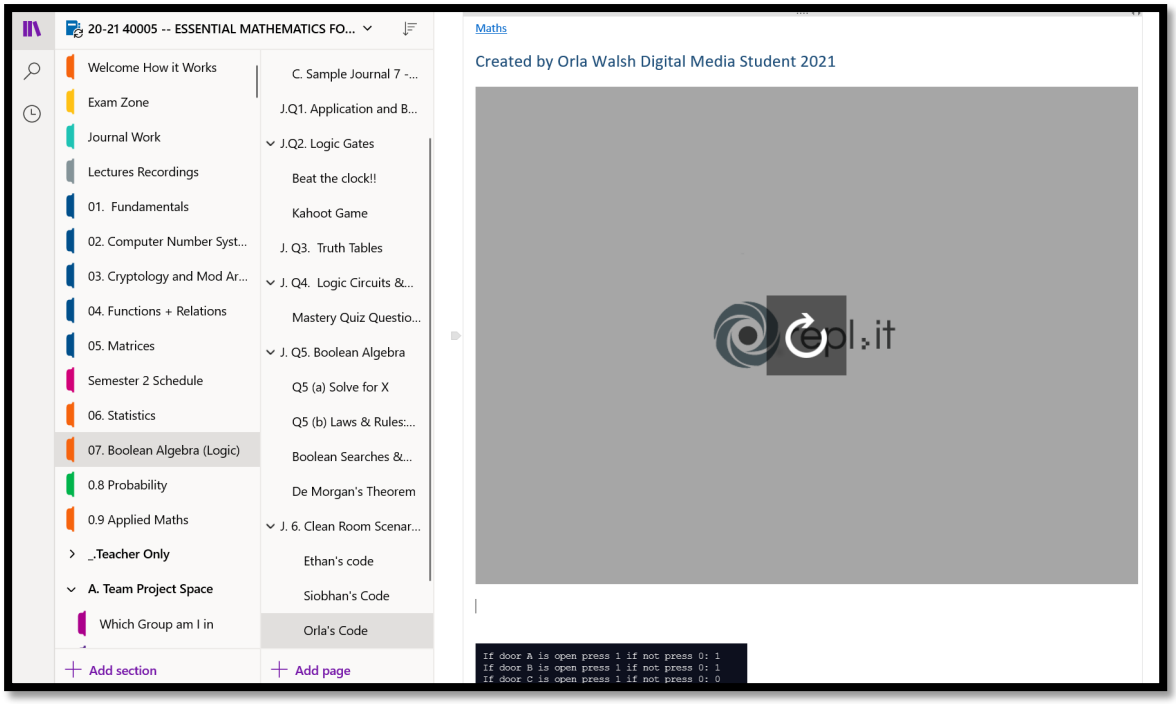

Figure 5: Interactive notes with embedded Repl.it IDE to run student's code.

Students often struggle to gauge how well they are performing in a module, especially when they are given many low stake assessments which give frequent feedback. The students co-developed an assessment tracker which is embedded in the maths app. This can also be presented as a standalone power app within Teams. Computing students made their own versions and the students reviewed and evaluated the design interface and usefulness of the app. This can be used to track grades and also predict how a student may perform. Figure 6 illustrates how the app can be embedded separately as a power app in Teams.

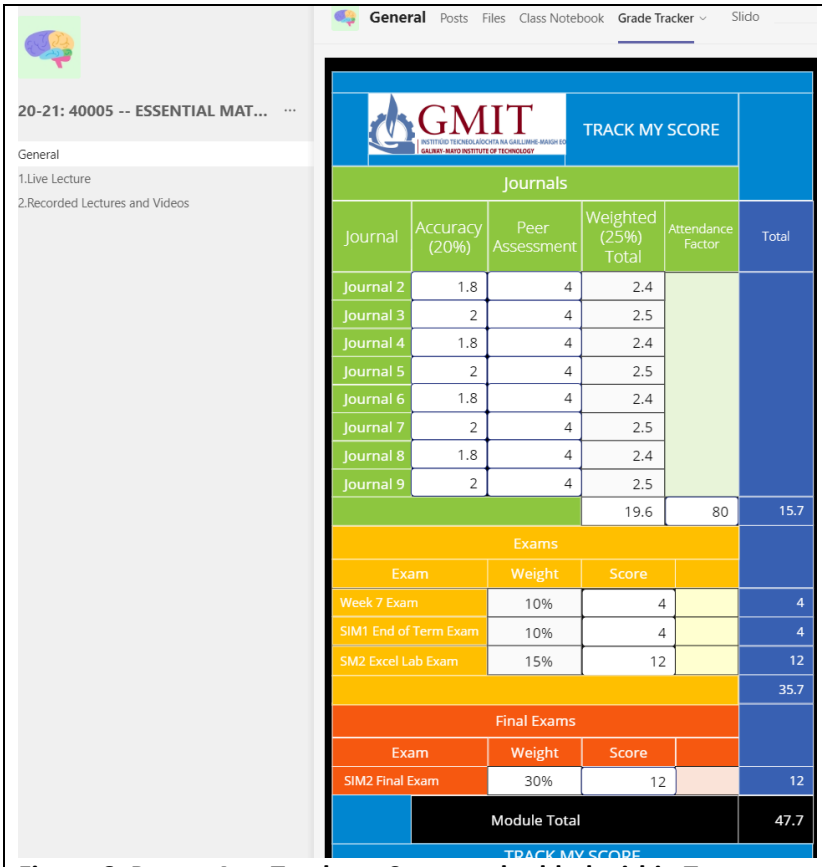

Figure 6: Power App Track my Score embedded within Teams

Students made videos explaining how they made the assessment tracker power app. See Figure 7 demonstrating how the power app was made the maths behind the functions within the app.

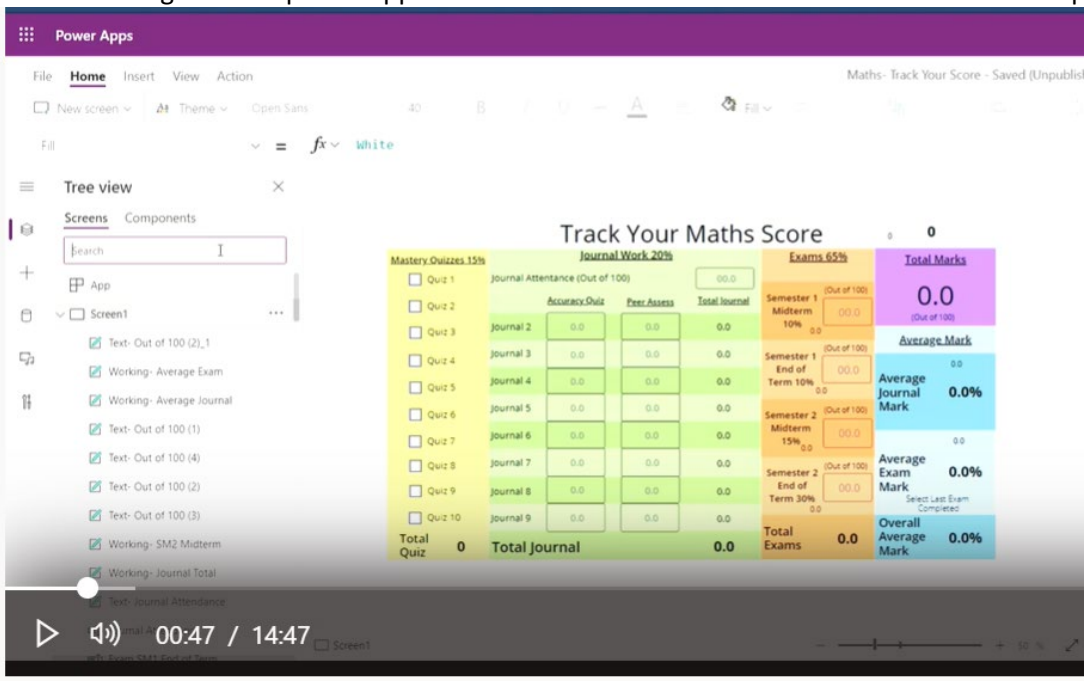

Figure 7: Student videos of how to make Track my grade Power App.

This year students were required to access all lectures and tutorial online using Teams. The app includes a calendar shown in Figure 8 with active links for lecture and tutorial times and join links. This can be useful in the early weeks and enables students to join other tutorial classes or the

maths drop-in classes with the Maths Learning Centre. Assessment deadlines are also built into the calendar.

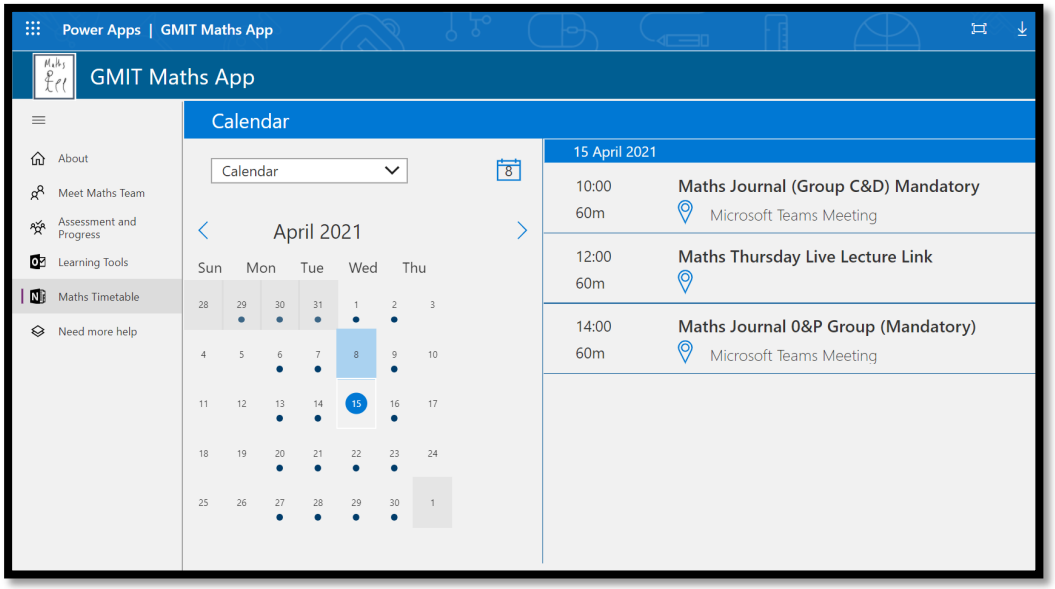

Figure 8: Maths calendar of live classes, assessment deadlines and maths drop in times.

The final section offers students additional supports in maths. There are 2 options currently active, a live link to booking page for the maths learning centre, the ability to book a 1-1 session with a member of the maths learning centre (Figure 9)

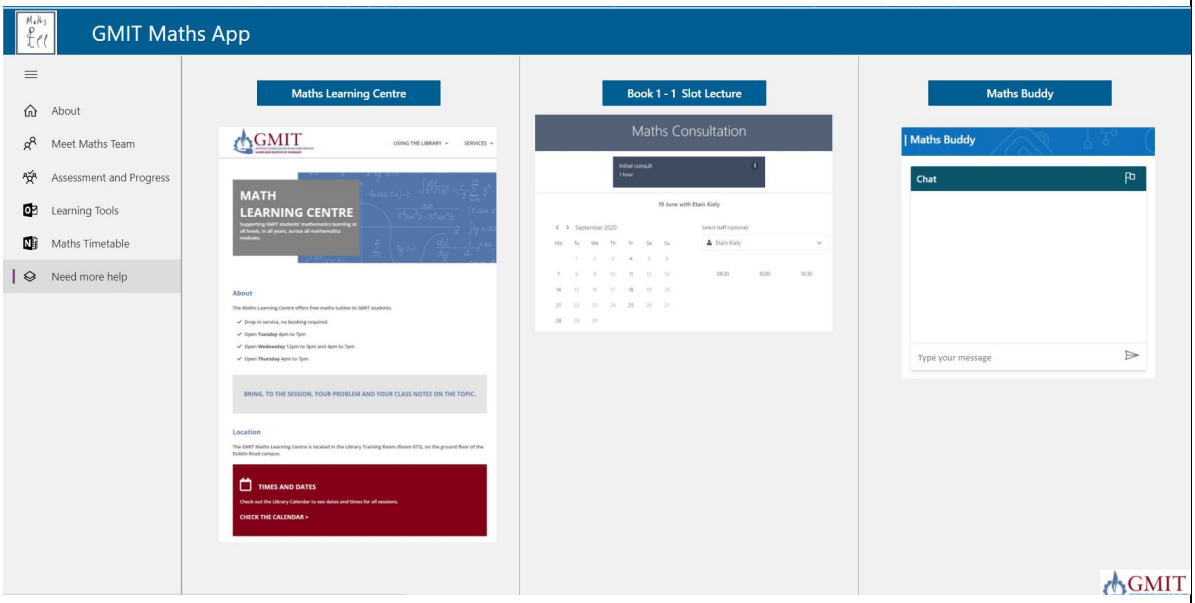

Figure 9: Additional Maths Support Page

An option that could be developed in future work would include embedded a chat bot “Maths Buddy”. This is an easily implemented intelligent tool, built on the Microsoft Power platform and Bot Framework. The Power Virtual Agent development process uses a guided, no-code, graphical interface approach to empower the lecturer to easily create and maintain an intelligent virtual agent. This can also be integrated into the Teams page. To develop this fully resources would be required in terms of time and services.

3. Key Learnings (Maximum 250 words)

This section can focus on identifying key learnings from the project on how these have been disseminated and embedded etc.

Key Learnings

The project sought to explore the potential of power app to transition and engage first year maths learners. A key learning has been that while there is a myriad of tools to engage and support learners this can lead to technology overload and confusion for learners in the early weeks of college life. This app brings many learning components together for students to a single access point. The app has been co-developed with first year 2021 computing students. A focus group evaluation of the maths app's interface and functionality will be conducted in May 2021. A full evaluation will be conducted in September 2021 with a first-year intake. Dissemination will follow with national conferences and international publications.

While a proof of concept has been developed here, due to licence types not all permissions are enabled to allow for full development. For example, to enable students personalised maths score would require row level permission which would require a pro licence for the student.

A full video demonstration can be provided on how to use the app.

Date: 31/03/21	*Signature:*

References

Callender, A. & McDaniel. M., (2009) The Limited Benefits of Rereading Educational Texts. Contemporary Educational Psychology , 34(1) 30-41.

Freeman., S, Eddy SL, McDonough., M, Smith., MK, Okoroafor., N, Jordt., H, Wenderoth., MP. Active learning increases student performance in science, engineering, and mathematics. Proc Natl Acad Sci

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Smith, M.A., & Karpicke, J.D. (2014). Retrieval practice with short-answer, multiple-choice, and hybridtests. *Memory, 22*(7), 784-802.