

# LEARNING ANALYTICS OF TOTEMM VIRTUAL LEARNING RESOURCES -TRANSFORMING TRANSNATIONAL INTERCULTURAL SENSITIVITY FOR MIDWIFERY STUDENTS THROUGH AN INCLUSIVE MOBILITY MODEL

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## Abstract

Equality, social inclusion, and participation of non-mobile midwifery students studying in England, Italy, Estonia and the Netherlands was of interest in this project. Five Virtual Learning Packages (VLPs) were created to address needs within maternity surrounding a sense of safety, positive lifestyle choices, needs for the migrant population, and psychological wellbeing for women and families. After reviewing the learning analytics for these TOTEMM VLP resources, they showed increase in peer engagement facilitation for most learners, showed consistent and completed usage through badges earned and module completions, and showed uptake of the required media and resources embedded into each lesson. Overall, the VLPs were well-designed and developed to produce results which demonstrate that learners can independently progress with minimal issues- or seek help via the help pages where necessary. There was moderate/strong peer-to-peer engagement, and anytime access was essential. A SWOT analysis was presented to detail where updates and improvement may be made to address limitations, and some data analysis limitations. The VLPs can be used by midwifery students to present much needed information validated by midwifery educators, and encourages peer to peer communication across Europe.

Keywords: Midwifery, Learning analytics, Moodle, Pedagogy.

## 1 INTRODUCTION

Previous research has explored the barriers to mobility activities in midwifery and the requirements for new approaches and resources to enable transnational learning to occur [1], [2]. The benefits for learners who engage in study mobility experiences include development of soft skills, interaction skills with individuals from different cultures, adaptability, and proficiency and communication skills in foreign languages.

The TOTEMM ERASMUS+ Strategic Partnership in Higher Education aims to promote equality, social inclusion, and participation of non-mobile midwifery students through the creation and implementation of a new inclusive mobility model [3]. The model is based on a combination of virtual and physical mobility activities. In addition, TOTEMM aims to investigate if the combination of activities can develop intercultural sensitivity [4]. In order to achieve its aims, 5 virtual mobility learning packages were co-created by engaging stakeholders in midwifery (students, academics, experts in the topics, learning technologists) in the development process [5].

The learning analytics of these VLPs were captured. Learning analytics are the measurement, collection, analysis, and reporting of data about learners and their contexts, to aid in understanding for how to optimize learning, and the environments in which it occurs [6]. Moodle [1] records the interactions by users, termed 'hits', on different assets such as pages, lessons, forums, access to files, click on URLs, and others. Therefore, this article presents the method and results of the analysing this data from the 9 VPLs to provide insight as to how students/learners are engaging and accepting the VLPs information, features, media etc.

Learning Analytics can inform the educational process and provide the tools to understand and enhance digital learning. Healthcare students' performance can be tracked and measured and areas for

improvement can be identified; Content providers can see how their content is used and they can improve it and adjust it; Educational institutions can understand the effectiveness of their teaching and learning methods, while health education policy makers can form global or custom criteria for the evaluation and rankings of their institutions [7]. Personalisation of student evaluation, by understanding the interrelated contexts of learning, teaching and expertise development can be achieved [8].

While intention of use of learning analytics has been discussed, there is little evidence that shows improvement of learning outcomes and support of teaching and learning, but there are indications for a shift towards “deeper understanding of students’ learning experiences” [8]. Different attempts to reproduce learning analytics findings in new contexts have tend to fail, meaning tools and methods used are not very robust [9]. However, work towards unified frameworks or taxonomies to understand students’ experiences and digital content development and interpretation have started to be shaped [10], [11].

## 2 METHODOLOGY

The ASPIRE framework stands for Aims, Storyboarding, Production, Implementation, Release, and Evaluation. The ASPIRE framework has been demonstrated to be effective in the development of reusable learning objects- enhancing both the knowledge and the confidence of participants in different topics [12]– [15]. The adaptation of the ASPIRE framework to develop Virtual Learning Mobility Packages (VLPs) enhances the quality of these developed resources. In this TOTEMM project, there was learner inclusion as stakeholders can aid in the development processes to ensure the learning resources have optimal chance of student satisfaction[16], [17]. Midwifery students studying in England, Italy, Estonia and the Netherlands were part of the design, development, and evaluation processes as Stakeholders along with subject experts/tutors, and learning technologists. This is an advantage in the co-creation process.

The first introductory VLP package was co-created, piloted, and adjusted. Following the lessons learnt from the pilot, 4 duplicate packages were co-created. Then, 4 core VLP packages were deployed, and participating mobile midwifery students studying in England, Italy, Estonia, and the Netherlands were split into 4 groups. Each group was assigned to an introductory package, and one of the 4 core public health VLPs:

- 1 Championing the Needs of the Migrant Population
- 2 Empowering Women to Maintain Their Sense of Safety
- 3 Optimizing Psychological Wellbeing for Women and Families
- 4 Promoting Positive Lifestyle Choices

All VLPs were developed in Moodle [18] utilizing different Moodle assets. These assets were fora, lessons, pages, modules, ULRs, labels, files, and folders. For example, the Module ‘Empowering women to maintain their sense of safety’ has within it a lesson called ‘Midwife’s’ role in maintaining women’s safety in healthcare facilities’. Users’ data were recorded from the use of all these packages. The data was downloaded from Moodle and combined into a single Excel file.

Different tools have been proposed over the years for Moodle data to be analysed such as GISMO or MOCLog [19], [20]. One of the most common tools used that does not require access to Moodle database are Excel Pivot Tables [21]. In this paper we firstly collected the data, then we cleaned the data and lastly, we used both Excel and SPSS for data analysis. We interpret the findings of the Learning Analytics towards the digital content development and potential barriers for the students and we present the findings as a SWOT (strengths, weaknesses, opportunities and threats) analysis.

## 3 RESULTS

The dataset has 36,636 points of data, with 3635 events in total. Therefore, the mean number of analytic events per student was 173. There were 71% of events as Lesson events, and 11% as system events, this equated to 82% of the data. The 5 Introductory packages were duplicates and had approximately the same data of hits ranging from 11.51% to 12.56%. As the number of learners was the same across the 5 introductory packages this can be interpreted that the “behaviour” on accessing resources across the packages, was the same. Having a same “behaviour” of accessing the introductory VLPs is an excellent baseline for use on other packages.

There was a similar number of hits from participants across the Modules. There were lower counts in the Introduction Pilot 1 and Introduction 1, but this was expected as they were in development and took time for engagement of learners when first introducing these packages into their curricula. Between these 4 VLPs and their introductory modules there were 20 lessons. Each lesson served a different purpose, and they cannot be compared against each other. However, we can understand the distribution of hits from users and determine for each lesson if engagement is satisfactory. There were 82 students in total, therefore the mean number of analytic events per student was 173. There were 71% of events as 'lesson' related events, and 11% as background system events, this equated to 82% of the data. Hits per learning package was ranging between 7.85% and 14.56%. These hits are depending on the design and available assets that a learner can click on, some course-specific packages had more information and were slightly longer in duration.

### 3.1 Date and Time of Usage

The distribution of usage was spread from November 2020 to September 2022. In spring 2021 the VLPs were released to students as part of the evaluation. This is reflected in the learner's use of the resources most frequently access was between 19th October 2021 and 16th November 2021, at the start of the evaluation. Overall, the VLPs were used equally across a similar time frame. When accounting for GMT differences, 17:00-17:59 was the Mode- around the most common time the resource was used. 25% used the resources before 11:30, 50% used the resources by 15:49, and 75% had used the resources by 19:38. 07:04 was the earliest someone used the resources, and 23:01 was the latest. Fig. 1 presents the mean percentile times for learners. It reveals that around 25% use the resources outside of the 9-5 working day (first 5% and last 20%). The need for 24-hour access is demonstrated here with a large range in time of use.

Module	Percentiles						
	5	10	25	50	75	90	95
An Introduction to Midwifery in Europe 01	9:39	10:34	13:08	16:05	18:08	19:44	21:01
An Introduction to Midwifery in Europe 02	8:44	9:17	10:08	13:28	16:18	19:32	21:01
An Introduction to Midwifery in Europe 03	9:20	9:56	11:58	14:48	18:33	20:44	21:43
An Introduction to Midwifery in Europe 04	9:34	10:21	12:55	15:18	17:30	20:07	21:36
Promoting Positive Lifestyle Choices	8:54	9:29	11:15	15:29	18:33	21:56	22:31
Empowering Women to Maintain Their Sense of Safety	8:06	9:07	11:26	14:20	16:56	18:49	20:16
Championing the Needs of the Migrant Population	9:17	10:25	12:46	15:08	17:23	20:20	22:11
Optimising Psychological Wellbeing for Women and Families	8:06	8:57	11:23	14:17	17:01	19:47	20:04
An Introduction to Midwifery in Europe - Pilot 1	9:17	9:46	11:29	15:49	19:37	21:30	22:05

Figure 1. Learners' times of usage in all packages

### 3.2 Lesson Events

A tour is a guide of a module, so a learner understands how to work through and complete the VLP. There were 945 times that learners started a tour, and 559 ending the tour by means of completion. In order to complete the VLP a learner has to complete all the lessons. The page at which the users ended the tours can be analysed by the page ID. These represented either the second to last page, last page, quiz page, or back to the welcome page. These IDs were acceptable to show they completed a tour. Furthermore, there were 68 hits registering after learners finished the quiz, indicating they visited the tour section on more than 2 times whilst progressing through the materials. The data for lessons started shows an average of 42 lessons starts, which, when divided by the 9 VLEs meant 4.6 lesson starts per Learner. 50% of these additional lesson starts was from restarting.

Therefore, we can deduce that around 50% of these lesson starts were from students performing the lesson more than once. The lesson can be started, restarted, or resumed multiple times, the above

numbers revealed that the students were not always finishing a lesson when they were starting it, and they were revisiting it in the future. From a learning design point of view this might mean that the learners benefit from knowing the duration of each lesson in advance in order to complete it in the appropriate chunks. The high number of start and restart in comparison with resume can be interpreted that the learners may have been unable to save- i.e. they changed computers. Or more likely they had limited time and had to quit before they could finish. Further analysis of the most frequent time to quit and restart is needed. In summary, 67% of tours were completed; students restarted lessons 1 extra time on average and approximately 90%-95% of all these lesson from each VLP were fully completed.

Row Labels	Lesson started	Lesson restarted	Lesson resumed	Lesson ended	Tour ended	Tour started
An Intro to Midwifery in Europe - Pilot 1	127	26	38	114	35	48
An Intro to Midwifery in Europe 01	107	15	48	102	8	32
An Intro to Midwifery in Europe 02	116	20	42	111	12	13
An Intro to Midwifery in Europe 03	131	24	45	104	10	10
An Intro to Midwifery in Europe 04	139	33	41	118	11	13
Championing the Needs of the Migrant Population	74	60	68	NA	4	4
Empowering Women to Maintain Their Sense of Safety	92	140	155	NA	2	3
Optimising Psychological Wellbeing for Women and Families	74	41	61	NA	5	8
Promoting Positive Lifestyle Choices	85	59	100		5	5
<b>Grand Total</b>	<b>945</b>	<b>418</b>	<b>598</b>	<b>549</b>	<b>92</b>	<b>136</b>

Figure 2. Breakdown of lessons and tours started, resumed, and ended.

### 3.3 Forums

Forums facilitate learners to view questions and answers, or post questions and answers without limit. For all 9 VLPs, there were 40 forum posts created, therefore an average of 2 posts per student. There were more answers posted, and although this suggests the average response was around 7 per learner, we have previously identified 5 students answering much more. Overall, it was desired that all learners engage with their peers, and this was mostly achieved:

- There were 80% learners posting questions or answers of the forum empowering women.
- There were 85% learners of the forum championing the needs of the migrant population.
- There were 95% of learners posting questions or answers for the forum promoting positive lifestyle choices.

Engagement of participants and peer learning seems to have been achieved. Participants viewed multiple forum posts regardless if they created posted a question or not, thus their interest regarding their peers' post was high. This meant learners were accessing large portions of information from peers likely to have the information they need for course progression. In summary, approximately 75%-95% of learners depending on the VLPs engaged in each forum. There were 5 learners posting more frequently and may have been core support for engagements.

### 3.4 Pages

Four Pages were accessible to all students. These pages served to help learners if support was required. The 4 pages were: *Help logging into Teams*; *How to start your meeting at your scheduled time*; *inclusive language*; *Introduce yourself and meet your fellow travellers*.

Having participated in the Teams meetings on the Introductory package when first using the introductory VLP packages, several learners were accessing the *Help logging into Teams* page. Most of them accessed

this page once, but there were 3-7 students needed support from the help pages. This is excellent when considering 82 learners were independently interacting with the resources for the first time. The page *Inclusive language* was part of the 4 modules, and the data shows 100% of participants accessed the page from all 4 VLP. Some learners required help from the *how to start your meeting* page in the introductory modules but did not go back for more help after, suggesting they were then independently learning.

### 3.5 Student Interactions

There can be issues if the progression of students has significant variation. There may be factors which affect individuals, and this can lead to a disparity within the same cohort of users. An ideal result is a consistent progression of learners that has little deviation between them. There was value in the module completion results to show consistent interactions and counts regardless of VLP. Fig. 3 showed the completed status of all types of events; pages, lessons, file/URL use, forum posting etc. The learners' interactivity is somewhat varied and can be explained by restarting or repeating lessons and/or tasks. Importantly, all but one participant (p80) completed their Introduction and their core/course specific lessons, as indicated in the raw data. In summary, participant engagement and task completions differed but the minimal requirements were met in all but one student. Explanation of these difference are from multiple posts in the discussions, or repeating lessons and re-completing modules.

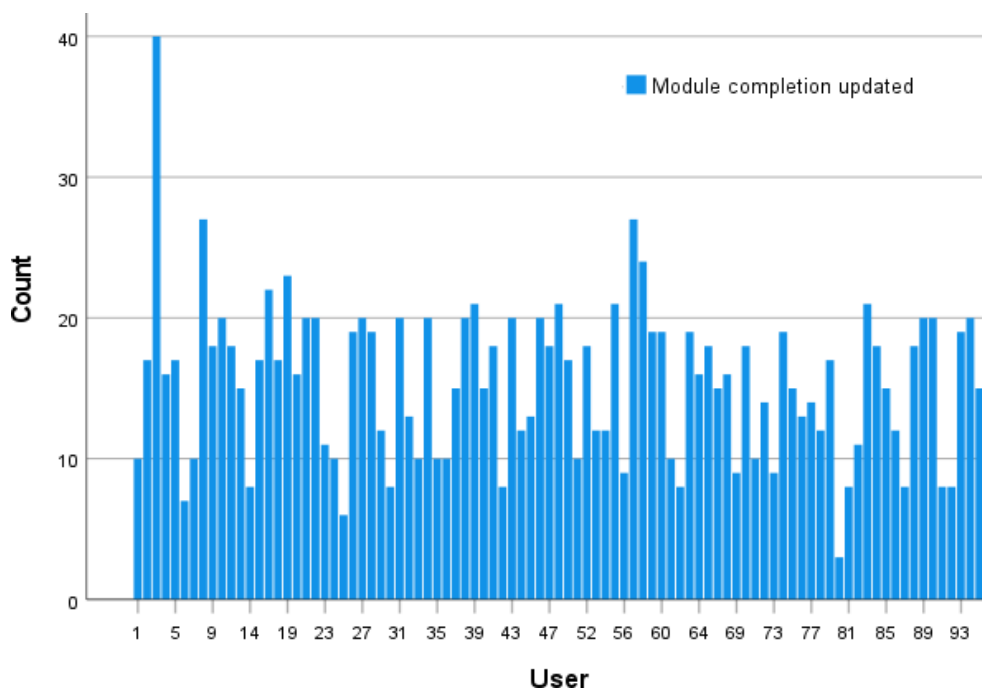


Figure 3. Varied distribution of module completions for each user- 2 was the minimal target

### 3.6 Average Usage for additional assets

There were other items in the forms of Website URLs, database, labels, and files. Fig. 4 shows additional hits to access these various items within the 9 VLEs. The close proximity of the average of the mean hits per asset can be interpreted that the users had the same "behaviour" of accessing all the VLPs. Some of the VLPs incorporated a different number of assets, so there can be minor differences (such as the forum *Optimizing Psychological Wellbeing for Women and Families* may not need the forum as much). These items are included within each lesson, and one limitation of these analytics is that the hits collected from lessons included these items and were unable to be separated. However, there were resources needed for learners to complete some course related tasks, so all learners should be similarly accessing these media types multiple times. We can summarize that as there are multiple hits for the 82 students, some of the assets were useful and the students wanted to access them multiple times, rarely did the VLPs required they had to.

Count of Event context	Column Labels						Grand
Row Labels	File	Forum	Page	System	URL	Total	
An Introduction to Midwifery in Europe - Pilot 1	16	307	79	437	79	918	
An Introduction to Midwifery in Europe 01	42	125	65	1574	75	1881	
An Introduction to Midwifery in Europe 02	43	299	68	1642	119	2171	
An Introduction to Midwifery in Europe 03	31	236	71	1328	126	1792	
An Introduction to Midwifery in Europe 04	39	238	69	1338	117	1801	
Championing the Needs of the Migrant Population	178	222	25	870	na	1295	
Empowering Women to Maintain Their Sense of Safety	96	310	28	1509	na	1943	
Optimising Psychological Wellbeing for Women and Families	146	128	20	835	na	1129	
Promoting Positive Lifestyle Choices	176	273	21	792	na	1262	
<b>Grand Total</b>	<b>767</b>	<b>2138</b>	<b>446</b>	<b>10325</b>	<b>516</b>	<b>14192</b>	

Figure 4. Data showing the frequency of Hits for additional resources in the 9 VLPs- this is subsequent to module completion and optional for learners.

### 3.7 SWOT analysis of Results

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. SWOT analysis is a strategic planning and/or evaluation tool to help decision- making to address limitations or for planning on improving weaknesses. It looks at internal (strengths, opportunities), and external (weaknesses, threats) that learning packages operate within. The SWOT analysis has narrow focus when completed as a standalone evaluation tool. The TOTEMM goals and contexts allow better SWOT evaluation to measure success of the VLPs, and application of the SWOT for future improvement are sure to align with TOTEMM strategic and pedagogical goals.

For TOTEMM, the VLPs may have strength in their facilitation in peer-to-peer communication via forums, opportunities for learners to further knowledge and skills with additional materials suggested. The weaknesses may be in the limited engagement with a minority of learners, and threats to the TOTEMM goals of transcultural sensitivity for healthcare students are external risks and consequences.

From analysing the TOTEMM data we start to answer the impact related questions formed at the start of the project. For opportunities and threats there were many possibilities for example- easily identified and rapid updates to substantially strengthen the VLPs; addition of features to improve maternity care education; tactics to reinforce usage and training, for consistent interaction. Threats included effects of incorrect information on promotion of equity and social inclusion; limitations in support of language, cultural, or educational difference of non- mobile midwifery students; and threats to learners' analytics, data integrity, inaccurate/incorrect information, and public health delivery. Therefore, from the results and the context we summarized the analytics for the VLPs in the subsequent SWOT Figure 5 below:

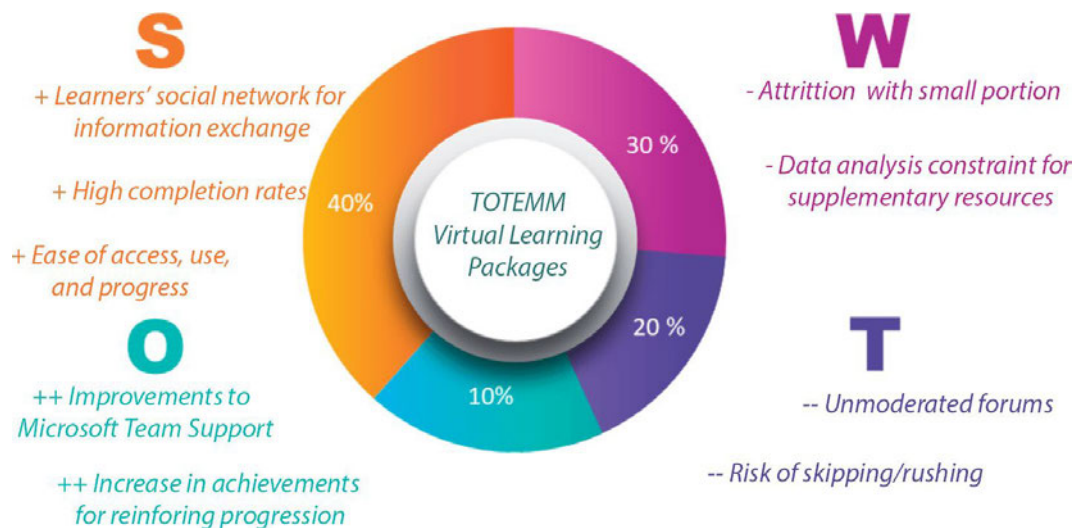


Figure 5: SWOT analysis summary of main findings

## 4 DISCUSSION

### 4.1 Summary of Findings

After reviewing the learning analytics for the TOTEMM resources, it can be summarized that about 25% of students were accessing the VLPs beyond their planned “studying day”- either early morning, or late afternoon and evenings. As the VLPs were not included in the formal curriculum, accessing beyond the busy day of midwifery students was partially expected. Time differences between countries are also considered in the interpretation of this data, but still a part of students needed to access them in different times of the day. In another study analysing knowledge and self-assessment sessions by trainees in medical education average hourly activity and length remained stable between 9:00am and 10:00a am [22] with some sessions spanning throughout the day. Having the VLPs as part of the curriculum might lead to more constituent learning times, which can drive the learner to better learning performances [23].

Approximately 67% of tours were completed, while 50% of these lesson starts were from students performing the lesson more than once. As a student can start, restart, or resume a lesson multiple times, findings revealed student need to go to an unfinished lesson many times. This can be interpreted that either a student did not allocate the right time to go through it or it was not clear how to continue (resume) from where it was last. Further investigations are needed around the usability of the Lesson asset. However, 90%-95% of all these lesson from each VLP were fully completed. For the majority of learners there was a similar consistency in usage. Students that participated in the VLPs accessed all the required information showing consistency of students' behaviour, while some students dropouts can interpret the above percentage of accessing the lessons. Students can be considered highly motivated as the visiting percentage of Lessons, which were holding the most of the VLPs information, is extremely high comparing with other reported studies [24].

The fora had many views per learner and Q & A postings had an average of 4 per learner. An excellent 85% - 100% of learners were posting, viewing, or discussing with peers in the forums. The forum is seen as a beneficial tool [25] supporting quality discussions and collaborative learning [26] , being available to complete their learning anytime and anyplace [27]. While peer learning appears to be achieved, the use of forums for submission of assignments needs to be reviewed. As was the case with one forum in a VLP, students used it to submit a team poster and view other teams' posters, however with choice few students viewed other works as they were not required to. Alternative assumptions could be that guidance was not clearly communicated to the students, or students thought that the task was complete. Student engagement in forum discussions can be further enhanced through increased facilitation from academics, providing feedback and promoting interactions [28]. Overall, these resources have moderate strength in facilitating social connectivity of learners and support/tour assistance addressed the issues some learners experienced.

## 4.2 Limitations

The forum content was not analysed and could have been insightful as to what questions the learners were asking. Text mining and sentiment analysis could have helped to understand what information was being asked for, and how we could have update lessons to include the necessary answers. From the SWOT analysis, to reduce threat to deviation in content quality/accuracy from peers a flagging system or feedback option could be implemented in forums. Interpreting learners' behaviour through learning analytics should be seen with caution as they can only be approximate indicators of use. Further investigation of limitations found have many external factors such as student's workload, language barriers, etc. that are not always known to researchers but may influence VLP usage for some students. We are unable to figure why some students had less engagement and uptake, however previously some students had access issues on certain computers and this possibility is likely.

## 5 CONCLUSIONS

The modified ASPIRE process included all stakeholders equally and formed the Virtual Learning Mobility Packages following virtual storyboarding sessions and a structured format of describing the content, piloted and evaluated by midwifery students. Students Learning Analytics of TOTEMM VLPs showed that students were engaged with the packages, enhanced their learning, utilised peer learning and found the platform easy to use. As with every online package, momentary visit session by clicking the "Next" button cannot be identified from the existing data, and unmoderated forums may post some threats if the VLPs are delivered in large scale audiences. Furthermore, there are opportunities for improving elements such as the VLPs around the synchronous meetings of a student audience in different time zones that have never met before; or the rewarding system to keep students continuously engaged through badges or gamification. Despite possible threats and weakness the TOTEMM VLPs showcased high completion rates and appear beneficial to midwifery students that encounter mobility barriers, but also to all the students that required online course/peer support and trusted resources.

The TOTEMM project set a best practice example on the implementation and adjusting ASPIRE process and tools for VLPs. Thus, educators, learning technologists, higher education institutions and other ERASMUS+ projects like the HEALINT4ALL will benefit from TOTEMM practices, both to co-create VLPs, but also to evaluate and analyse its Learning Packages.

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