TSG Agenda

TSG 49: Distance Learning, e-learning and blended learning of mathematics

Class: A (Class A for TSGs with odd numbers; Class B for TSGs with even numbers)

**Please prioritize the sessions in “core-time” (from 19:30-23:00, Beijing time, i.e. Session 2, 3 for Class A and session 1, 2 for Class B) as they are friendly to most of the time zones in the world.

N.B. We were given an extra session time due to high numbers of papers (named as Session 4, July 17th 14.30 – 16.30)

Session 1: Short oral (14.30 – 16.30)

1. 14.30 – 14.45

    Title of Paper: **FOSTERING HIGHER ORDER THINKING IN THE FLIPPED CLASSROOM - AN ANALYSIS OF STUDENTS PROOF SCHEMES**

Author(s):

Jennifer Rothe

Institution: Universitaet Leipzig, DE

Country/Region: Germany

Abstract:

In comparison with traditional learning arrangements flipped classroom scenarios offer a way to redirect the use of time and resources. The preloading of learning content using videos allows for time during the in-class phase to be spent on activities fostering higher order thinking. In this study a flipped learning scenario was developed teaching different proofs of the Pythagorean theorem. Due to circumstances during the COVID-19 pandemic the in-class phase had to be changed to an e-learning scenario. This led to new research questions regarding the importance of the in-class time in a flipped classroom. Results suggest that students experience difficulties in achieving higher order learning goals in the changed

scenario due to the teacher not being directly available to explain new content or answer questions. This especially affects students with a low level of prior knowledge.

2. 14.50 – 15.05

Title of Paper: STUDENT ENGAGEMENT IN A MATHEMATICS CLASSROOM

Author(s):

Mustafa Cevikbas

Gabriele Kaiser

Institution: University of Hamburg

Country/Region: Germany

Abstract:

The flipped classroom (FC) approach has become an increasingly popular research topic in recent years. The core idea of FC is to transfer lectures out of the classroom with the help of digital technologies and to allocate in-class time for active learning. The purpose of the presented case study was to investigate student engagement in a flipped secondary mathematics classroom. The participants were a mathematics teacher and 33 students from a high school in Turkey. The results indicate that FC has the potential to increase student engagement from behavioral, emotional, and cognitive perspectives, providing students with many advantages. However, engagement was found to be negatively affected by learning barriers against this type of teaching and learning.

3. 15:10 – 15:25

Title of paper: **DELIVERY OF ELECTRONIC ASSESSMENTS IN A FIRST YEAR BASIC MATHEMATICS COURSE AT MASENO UNIVERSITY, KENYA**

Author(s):

Cameline Nafula Orlendo

Institution: Maseno University

Country/Region: Kenya

Abstract:

In this paper I document my course offering online assessment of a foundational mathematics course to around 1000 first year, first semester students at Maseno University, Kenya. The period of course delivery is during the September 2019 – December 2019 semester in the the university's 2019/2010 academic calendar. The online assessments are delivered through STACK. The primary goal is to provide weekly electronic mathematics assessments using STACK.

4. 15.30 – 15.45

Title: **HYBRID ENVIRONMENTS OF LEARNING: TEACHER EFFICIENCY AND POTENTIAL FOR STUDENT LEARNING BY COLLABORATION**

Author(s):

Veronica Hoyos

Estela Navarro

Victor Raggi

Sergio López

Institution: National Pedagogical University

Country/Region: Mexico

Abstract:

This paper describes the framework, methodology, analysis, and results of an exploratory study around the implementation of a hybrid learning environment designed to address the teaching and learning of the subject of functions. This subject is usually addressed in the first year of college during two weeks of face-to-face activity in the classroom. As part of the exploratory study, a hybrid environment of learning was designed to be implemented as follows: a) in the first week, the students worked independently in a virtual environment uploaded in a moodle platform; b) during the second week, the subject was addressed under teacher's guidance into the classroom. As a result, it was obtained improvement in teacher practice and refinement or validation of the student conceptions; those previously showed

during their work at the platform. So, there was evidence of teacher efficiency and also of the potential for student learning by collaboration.

5. 15.50 – 16.30 Questions/Discussion

Session 2: Short Orals July 14th 19.30 – 21.00

1. 19.30 – 19.45

Title of Paper: **STUDENTS ENHANCEMENTS AND PRAXEOLOGIES ON LEARNING INTEGER OPERATIONS USING GEOGEBRA**

Author(s):

Rosie Lopez Conde

Merlyn M. Lingo

Jurdil Faith D. Salas

Country/Region: Philippines

Abstract:

In this study a learning trajectory was developed which improved students' performance on integer operations. This quasi-experimental research aimed to determine the enhancements and praxeologies developed among fifty-five (55) Grade 7 students on learning integer operations using GeoGebra. Based on the results of the study, GeoGebra served as a good environment for blended learning for students to perform the four operations on integers through exploration, hands-on, visualization and interactions as manifested in their feedbacks and praxeologies. There is a significant difference of 0.002 as indicated in the t-test in the performance between the experimental and control group. Thus, the experimental group performed better in the test compared to control group.

2. 19.45 – 20.00

Title of Paper: **TRANSFORMING NUMERACY PROFESSIONAL DEVELOPMENT FOR PRE- AND IN-SERVICE MATHEMATICS TEACHERS AND FAMILIES THROUGH E-LEARNING**

Author(s):

Leicha Bragg

Chris Walsh

Tracey Muir

Institution: Deakin University

Country/Region: Australia

Abstract:

Approaches to teaching children and young people numeracy often lacking cross-curriculum connections and relevance beyond the classroom. Supporting educators and families to build and strengthen students' numeracy capabilities through online professional development provides an opportunity to engage educators and families in the one space, in a readily accessible environment. We present a multipronged approach to transform the provision of numeracy professional development for educators and families through the design of three open-access resources. These dynamic resources, which are described in this paper, demonstrate how the principles of heutagogy were used to ensure the resources were learner-centred and learner-determined. This innovative elearning approach assists mathematics

3. 20.05 – 20.20

Title of Paper: **GENDER DIFFERENCE IN MATHEMATICS PERFORMANCE: ONLINE VS FACE-TO-FACE**

Author(s):

Peter Joseph Esperanza

Ma Khristin Fabian

Institution: Barstow Community College

Country/Region: USA

Abstract:

Institutions are continuing to expand their offerings of traditional face-to-face learning modules online. It is thus customary to investigate whether the different offerings facilitate the same level of student achievement. This study investigates student performance of 56 first

year undergraduate students taking a statistics module. Delivery had no treatment effect in student performance. However, there was a treatment effect for male and female students. Male students in face-to-face classrooms performed better than online male students. Whereas, female students who engaged in online learning environments performed better than students in traditional face-to-face classrooms. This finding suggests that online classrooms was able to support female students over the standard face-to-face classrooms better. An implication for practice is to incorporate elements of online discussion in face-to-face modules via blended learning strategies. This provides students the opportunity to verbalise their understanding of math concepts in their own time, at their own pace.

4. 20.20 – 20.35

Title of Paper: **USING FREE SOFTWARE TO IMPLEMENT VERIFICATION PROBLEMS WITH PARAMETERS**

Author(s):

Ilya Alexandrovich Posov

Dmitry Irikovich Mantserov

Institution: Saint Petersburg State University

Country/Region: Russia

Abstract:

The paper discusses the special type of interaction in computer-aided assessments: rewrite a condition on a functions with parameters with a logical expression on its parameters, and then proposes ways to implement it by means of free educational software: GeoGebra and Sage. The example implementations are provided, and they may be used as templates to author other problems of the same type. It is enough to have only a modern browser to work with problems. Some connections with e-learning standards are discussed.

5. 20.40 – 20.55

Title of Paper: **DESIGNING TASKS TO IMPROVE PLANE TRANSFORMATION USING DGE WITH TOUCHSCREEN**

Author(s):

Marcelo A. Bairral

Alexandre Assis

Institution: Federal Rural University of Rio de Janeiro

Country/Region: Brazil

Abstract:

Plane transformation it is still absence in Brazilian school curricula. When it is taught it is mainly based on identification of the type of the transformation and using only static drawings on paper. In this article we illustrate designed tasks on GeoGebra with touchscreen and reflect about the design of them to improve plane transformation in High School with students without previous instruction in this content. The set of designed tasks is being fruitful to make emerge concepts related with plane transformation and to help students solve them making composition among some of them. The study highlights that the decision on the nature of the task is related with the type of touchscreen devices used. This intertwined process is challenging for both teaching and the design-based research.

Session 3: Long Oral July 17th 21.30 – 23.00

1. 21.30 – 21.55

Title of Paper: **UNDERSTANDING AND CREATING TO BETTER UNDERSTAND INSTRUMENTAL PROOFS IN MATHEMATICS CLASS**

Author(s):

Philippe Richard

Institution: Universite de Montreal

Country/Region: Canada

Abstract:

Understanding and modelling the conditions for learning mathematics, together with the creation of models and computer means to understand them, are at the heart of the research. The QED-Tutrix system, which supports the student during the solving of problem of proof, was designed in accordance with the discursive practices developed in the classrooms and was developed with a focus on the designer-user dialogue. In this system, the original creation of inferential graphs, combining a set of structured reasoning with the statement of a problem so that a virtual pedagogical agent can follow the student in his or her proof, is based on the reference frame of mathematical properties and definitions that are in use in the school. Thus, the justification of a reasoning step is done according to this reference frame and makes it possible to legitimize the necessity in the linkage of knowledge. However, until

now, these justifications have been strictly verbal, like the reasoning in traditional mathematics. What happens if, for some inferences, interacting technological tool is used as a justification, such as building a dynamic figure, executing an algorithm or modelling a real situation? It is by exploring these means that we formulate our purpose.

2. 22.00 – 22.25

Title: **CASE STUDY ON THE CHANGE PROCESS OF A MATHEMATICS TEACHER IN AN ONLINE PROFESSIONAL DEVELOPMENT COURSE**

Author(s):

Stefanie Schallert

Robert Weinhandl

Institution: Johannes Kepler University Linz

Country/Region: Austria

Abstract:

It is crucial for designing online professional development courses to know which elements of a change process teachers face while participating in such courses. However, teachers' change process in online learning environments is still a rather poorly researched subject. Thus, we adopted a case study approach to examine the different elements of a change process of a secondary teacher within an online course for mathematics teacher training. Several asynchronous online discussions, as well as task submissions, were collected over two years. To get even more insights, an interview was conducted, and data was analysed following principles of grounded theory approaches. Results of this single case study indicate that teachers could face the following four elements of a change process a) improvement of technical skills b) change of didactical scenarios c) change of teacher role d) change of assumptions and beliefs. Further research should compare the results presented in this paper across cases in multiple case studies

3. 22.30 – 22.55

Title: **WORKSHOP ACTIVITY IN ONLINE COURSES OF MATHEMATICS EDUCATION: INSIGHTS FOR LEARNING AND ASSESSMENT**

Author(s):

Niroj Dahal

Institution: Kathmandu University

Country/Region: Nepal

Abstract:

Designed to explore effective pedagogical uses of the Workshop activity tool, which is native to Moodle learning management system, the study reported in this article was an action research. Using the standard steps of planning, intervening, assessing effectiveness, and information sharing, the study sought to identify the best ways to engage students in the process of learning and peer assessment by using Workshop as a learning and assessment tool for MPhil in Mathematics Education for the course Graph and Network. After identifying some challenges against students learning during the submission and peer review process, this article highlights some key strengths of the Workshop activity application, based on my study. Then it discusses the application's key affordances for conducting peer and self-assessment, for enhanced engagement in learning, and for the development of higher-order skills such as analysis and evaluation. I conclude by noting that effective use of the tool demands teachers' careful attention to issues such as time provided, peer allocation, and students' skills for effective tool use.

Session 4. Short Oral/Long Oral July 17th 14.30 – 16.30

1. 14.30 – 14.45

Title of presentation: **THE ROLE OF THE LECTURER IN FACILITATING PRODUCTIVE MATHEMATICAL CONVERSATIONS IN ONLINE MATHEMATICS PRE-SERVICE TEACHER EDUCATION**

Author:
Tracey Muir

Institution: University of Tasmania

Country/Region: Australia

Abstract:
The increase in online education has implications for mathematics teacher educators who are tasked with teaching mathematics content and pedagogy to pre-service teachers outside the classroom setting. Discussion boards are commonly used as forums for online students to contribute posts, yet little is known about whether or not productive mathematical discussions

can occur in such forums. This paper provides an example of an online forum, which highlights how pre-service teachers can be engaged in productive online mathematical discussions, particularly when facilitated by the instructor's and other learners' presence.

2. 14.50 – 15.05

Title of presentation: **PARTICIPANTS PATTERNS OF INTERACTION WITHIN AND ACROSS SOCIAL NETWORKS IN A MASSIVE OPEN ONLINE COURSE FOR EDUCATORS**

Author(s):
Heather Allmond Barker
Karen Hollebrands
Gemma Foust Mojica

Institution: North Carolina State University

Country/Region: USA

Abstract:
In this study, we examined the discussion forum posts of 159 educators from 46 countries who participated in a Teaching Mathematics with Technology Massive Open Online Courses for Educators. We used social network and sentiment analyses, as well as analysis of trends in engagement, to identify characteristics of small group interactions, including participants' dispositions that led to productive online discussions.

3. 15.10 – 15.25

Title of paper: **A REFLECTIVE PRACTICE ON AN ONLINE MATHEMATICS CLASS**

Author(s):
Haoyi Wang

Institution: University of Illinois at Urbana Champaign, US

Country/Region: USA

Abstract:
With most courses turning into distant formats, what are the benefits and hindrances of conducting university math courses using multiple technologies? In this e-learning environment, are content- neutral platforms necessary for teaching and learning in these classes? Specifically, what activities on the Moodle e-learning platform are more effective than others in supporting undergraduate student math learning and achievement? This paper will report on a reflective practice that examines both qualitative and quantitative datasets in understanding the implemented multimedia distance learning environment at an entry-level

math classroom at a large state university in the Midwest and its resulting consequences on the math learning and assessment performance of the students.

15.35 – 16.00

Title of paper: **EXPLORATORY STUDY OF TECHNOLOGY ASSISTED LESSON STUDY**

Author(s):
Dovie Louise Kimmins
Rongiin Huang

Institution: Middle Tennessee State University

Country/Region: USA

Abstract:

To address obstacles of adopting LS at scale in the USA, this study investigates how a technology-assisted LS (TALS) approach could remove the obstacle of scheduling. A LS with 3rd grade teachers was conducted using Swivl technology to videotape lessons and Zoom videoconferencing for debriefings, with the result being that the TALS promoted teacher learning as indicated in traditional LS while removing the scheduling barrier. School district participants in the study believe that TALS demonstrates potential to be sustained and implemented at scale after development of facilitators.

Note:

Class A:

- Session 1: 14:30-16:30 Beijing time, July 13th
- Session 2: 19:30-21:00 Beijing time, July 14th
- Session 3: 21:30-23:00 Beijing time, July 17th
- Session 4: 14.30 – 16.30 Beijing time, July 17th

Class B:

- Session 1: 19:30-21:00 Beijing time, July 13th
- Session 2: 21:30-23:00 Beijing time, July 16th
- Session 3: 14:30-16:30 Beijing time, July 17th