Every mathematics teacher at university level has experienced the difficulties met by first-year students even by students who were very successful at secondary school. Students requiring help because they feel unable even to start solving a problem or students proposing inadequate reasoning or proof (EMS Committee on Education, 2011) are just two among many possible problematic situations.

The following example is given by Nardi & Iannone (2005). First year students were asked to answer the following question:

Let $x \neq 2$ have the following properties: $x > 0$, and $\frac{1}{n} < x < \frac{1}{n}$ for every $n \in \mathbb{N}$. What is $x$?

One of the students answered as follows:

Should the teacher conclude that the student was not able to answer the question because it is too abstract for him? That this student did not understand the concept of limit? Or that the student found the answer but was not able to formulate it properly? And how is it possible to help this student?

We note that the student, in his answer, only uses a few English words but many symbols. He tries to produce an answer that looks like a university mathematics sentence. He does not recognise the different status of $n$ (any integer) and of $x$ (a fixed value). He might have encountered the argument $\frac{1}{n} < \frac{x}{n}$ used to prove that a sequence $(u_n)$ tends to 0, and reproduces the conclusion, wrongly applying it to $x$. However, he finally seems to understand that $x$ is not a sequence but a single value, and gives the answer $x = 0$. Some further work, devoted to exercises involving several letters with different status, might help him avoid such confusions and the teacher could also ask him to use more text and normal words in writing his solutions.

More generally, mathematics education research on the secondary-tertiary transition provides results that can contribute to interpreting novice students’ difficulties and proposing possible support for these students (de Guzmán, Hodgson, Robert & Villani, 1998; Artigue, Batanero & Kent, 2007; Gueudet, 2008; Thomas et al., 2012). We offer below a short summary of some of these results and evoke some teaching devices which have been recognised as successful in overcoming transition difficulties.

**Level of abstraction**

Some of the research studies that address what is often called advanced mathematical thinking have provided evidence that the concepts encountered at university are more abstract and thus require advanced thinking modes (Tall, 1991). A sequence of real numbers $(u_n)$, for example, is already an abstract concept. Working on sequences, the students have to figure out an infinite list of numbers, labelled by integers. At university level, students not only study sequences (their nature, their possible limits and so on) but they also have to perform operations on sequences and have to consider sets of sequences and vector spaces of sequences, for example, which means a high level of abstraction.

**Research results concerning specific topics**

Some of the research work concerning transition focuses on specific topics and identifies features of these topics that raise delicate issues for lecturers in charge of their teaching. For example, the historical development of linear algebra evidences that this theory has been introduced to unify different areas. Several mathematicians observed similarities between problems concerning functions and problems concerning sequences, for example, and suggested that this could be explained by a single, general theory (Dorier, 2000). This very long process cannot be reproduced in a linear algebra course, where students encounter this Formalising, Unifying and Generalising theory (Robert, 1998) with no possibility of experiencing the need for it. Some students, for example, are unable to convey a meaning to the concept of supplementary subspaces because they do not associate any representation with this general notion.

Other obstacles are connected with wrong intuitions, for example when students have to deal with infinity. González-Martín (2009) has identified such difficulties about infinite sums: students consider, in particular, that the sum of an infinite number of terms should be infinite. Such difficulties are very hard to avoid but knowing them usefully informs the teacher, who can refer to this geographical map of difficulties to build their teaching.

**New mathematical practices and norms**

In a previous paper in the EMS Newsletter, we introduced the notion of sociomathematical norms, as practices of
participation and performance regarded in a mathematic-
ics lesson as proper or correct (EMS Committee on
Education, 2013). These norms are certainly different at
university from what they are at secondary school.

With this perspective, one can consider that entering
university is like entering a new country, with a new lan-
guage and new rules. Students have to learn this language,
using new signs like quantifiers and using language in
new ways (Chellougui, 2009; Stadler, 2011). The example
given at the beginning of this article (Nardi & Iannone,
2005) can in fact be interpreted in this way.

The change in sociomathematical norms between
secondary school and university also concerns the proofs
expected from students (Dreyfus, 1999; EMS Commit-
tee on Education, 2011). In many countries, schools fo-
cus more on argumentation; hence deductive proofs are
new requests for the student entering university (Mari-
otti et al., 2004; Engelbrecht, 2010). These new requests
are not always the object of explicit teaching at univer-
sity (Hanna & de Villiers, 2008; Henni, 2008). Even the
models that could be provided by university textbooks
are not reliable enough: variations of rigour in proofs are
observed in textbooks, as noted by Durand-Guerrier and
Arsac (2003), for example about (E,D) proofs. Sometimes,
the link between E and D is made explicit by a notation
like D sometimes it remains implicit.

Some of the new mathematical practices are diffi-
cult to grasp for students, in particular because they remain
implicit. Another factor of difficulties is that some prac-
tices require a kind of expertise. University mathematics
resembles more and more the experts’ mathematics: stu-
dents have to find examples, develop a flexible use of dif-
f erent kinds of representations, make attempts and con-
trol these on a theoretical level, etc. (Lithner, 2000; Harel,
2008). Mathematicians often refer, for this purpose, to a
repertoire of familiar situations but building such a rep-
ertoire is a long-term process (not so long, perhaps, for
brilliant students but the teachers naturally need to be
able to support all kinds of students!).

A difference of culture between secondary
school and university
Another kind of explanation is linked to the basic obser-
vation that university and secondary school are different
types of institutions (Chevallard, 2005), with different
cultures (Hall 1981), thus shaping the way mathematics
is taught (Artigue, 2004).

At the secondary level, given a certain topic, students
often meet only a limited number of tasks, not connected
to each other, each of them being associated only with
a given technique used to address it (Bosch, Fonseca &
Gascón, 2004). For example, in many countries, compute
the limit of a function at +d is done at secondary school,
for a given function, by referring to familiar functions
(Praslon, 2000); the students cannot refer to a formal
definition of limit, which is not presented at this stage. At
university, the students can still be asked to compute
the limit of a function at +d but it might be very general, for
a function characterised by some properties. Moreover,
the students can refer to a theory of limits, which articu-
lates the different possible tasks and problems (Winst-
w, 2012). The university culture also comprises the intro-
duction of many new concepts and properties in a limited
time and there is a need for substantial mathematical au-
tonomy by the students: in the choice of a method, in the
building of a counter-example, etc.

Supporting transition to some successful
eamples
The findings briefly exposed here correspond to causes
of the novice students’ difficulties. Naturally, in many
countries these findings have informed the design of courses
specifically intended to help students overcome
these difficulties. A summary of many interesting initia-
tives can be found in Holton (2001).

These initiatives can take the form of bridging cours-
es: additional teaching, given at the very beginning of the
first university year, trying to fill the gap between sec-
dary school and university, often by proposing exercises
only requiring secondary school knowledge but asking
for more autonomy (e.g. Biehler et al., 2011, develop a
bridging course using an online platform).

In several universities, support courses are offered for
volunteer students or for students who encounter diffi-
culties (e.g. the Tremplin operation at the University
of Namur in Belgium, with sessions centred on questions
raised by the students). In other places, the pedagogical
organisation of the courses has been changed to foster
more mathematical activity and involvement from the
students. In Helsinki, for example, the courses are de-
voted to the completion of tasks by the students under
the supervision of an instructor (Hautala et al., 2012).
In Barcelona (Barquero, Bosch & Gascón, 2008), a study
and research paths (SRP), guided by a given question,
are proposed to students (e.g. how to predict the short-
and long-term evolution of a population size). Naturally,
the needs, and possible relevant teaching approaches, are
different for mathematics majors, engineering students
(Jaworski & Matthews, 2011), biology students, etc.

The design of courses for novice students could pro-
vide the opportunity for rich collaborations between
mathematicians and mathematics educators!

Authorship
Even though certain authors have taken the lead in each
article of this series, all publications in the series are
published by the Education Committee of the Europe-
an Mathematical Society. The committee members are
Tommy Dreyfus, Ghislaine Gueudet, Bernard Hodgson,
Celia Hoyles, Konrad Krainer, Mogens Niss, Juha Oik-
konen, Núria Planas, Despina Potari, Alexei Sossinsky,
Ewa Swoboda, Günter Törner, Lieven Verschaffel and
Rosetta Zan.

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peuvent nous apporter les recherches didactiques et les innova-
tions développées dans ce domaine? In Canadian and French
mathematical societies, 1er Congrès Canada-France des sciences
mathématiques, Toulouse, http://pedagogie.ac-toulouse.fr/math/mati-
sons/post_bac/informations/colltoulouse.pdf.
Executive Committee meeting
The new Executive Committee (EC) met in Berlin, 21-24 May 2013. A main concern of the 1st meeting of the new EC was to ensure that the ongoing programmes, carried out so diligently by the previous EC, would continue smoothly alongside and consistently with the planning of forthcoming events. The EC plans to meet once a year (working through email communications and Skype meetings in between). These meetings will take place in different parts of the world so that the hosting communities of mathematics educators can have the opportunity to benefit from the visiting EC members (via lectures, workshops, etc., by the EC members).

AFRICME
The 4th Africa Regional Congress on Mathematics Education (AFRICME 4) was held in Maseru, Lesotho (11-14 June). Nkosinathi Mpalami was the Chair of the Congress Steering Committee.

The meeting was attended by 53 participants from the USA, UK, France, South Africa, Malawi, Botswana, Swaziland, Kenya, Uganda and Lesotho. Many of the participants were young researchers (doctoral students or recently graduated PhDs). Michele Artigue and Jill Adler reported that the conference was very well organised, with a good scientific quality and a friendly atmosphere. The three plenary lecturers were by John Mason, Mamokgethi Setati Phakeng and Michele Artigue. The majority of contributions referred to teacher education and practices, with a strong emphasis on linguistic diversity. Ferdinando Arzarello, ICMI’s president, greeted the participants via video conference.

AFRICME and other planned activities across Africa (e.g. the planned CANP meeting in Tanzania in 2014 and the Espace Mathématique Francophone meeting in Algiers in 2015) constitute a major effort for enhancing mathematics education within the continent through supporting the creation of regional networks of practitioners and researchers.

ICMI STUDY 23: Teaching and learning whole numbers in primary mathematics classrooms
The IPC meeting of the study will be held in Berlin (19-24 January 2013) under the responsibility of the co-chairs Mariolina Bartolini Bussi and Xuhua Sun (University of Macau, China). The main aim of this meeting is the preparation of the Discussion Document to be distributed worldwide. Further information will be given in the next issue.

Archiving
The ICMI is launching a joint initiative with the International Mathematical Union (IMU) to build and maintain archives to contain existing and future records which may be of historical and practical interest for the present and future generations. These archives would consist of primary source documents, photographs, recordings and more that accumulate as the organisation functions in its everyday life. The IMU and the ICMI decided to devote efforts to undertake archiving in the most professional manner in order to select, classify and organise the records. Efforts are also invested in order to choose the most up-to-date technological infrastructure to store the records for easy and efficient access.

Some of the archives will remain secret for 70 years due to their sensitive contents (e.g. deliberations on the Awards Committees). The ICMI archive will be part of the IMU archive, which is located in the Berlin headquarters of both organisations. The curator of the IMU archive is Guillermo Curbera and the archivist is Birgit Seeliger. Bernard Hodgson was appointed as the curator of the ICMI archives and he has already started to work on it. We are confident that, given Bernard’s meticulous and responsible way of working and his passion for history, the resulting archives will become a wonderful resource at the service of the ICMI community.