Final Project Report
Reporting time
15.11.2021 – 15.11.2022

New Curricula in Precision Agriculture Using GIS Technologies and Sensing Data

University Oran1 Ahmed Ben Bella
Fac. Life/Nature Sciences / Fac. App/Exact Sciences

Co-funded by the Erasmus+ Programme of the European Union

Joint Project: Capacity Building in the Field of Higher Education ERASMUS+ 2018

Plan

- Transversal issues and regional cooperation
- Curricula: updated and new courses, curricula description, teaching materials, pilot teaching.
- Quality assurance
- Laboratories: equipment retrieve+dispatch task, exploited laboratories in the launched curricula.
- Dissemination and sustainability
- Conclusion

Transversal issues and regional cooperation

- The two promotions of students (first promotion 14 students in September 2021, second promotion 31 students in September 2022) come from various regions of Algeria. Thus, our training succeeds to give the opportunity to people leaving in agricultural regions with fewer opportunities to access training on agriculture with technologies.
- Some public institutions (e.g., DSA - Agricultural Services Management of the District of Oran, ITCM Hassi-Bounif - Oran - Technical Institute of Vegetable Crops, etc.) are very interested by using precision technologies in agriculture. They helped us in preparing the experimental field at the university, and look for the opportunity to see these technologies in practice.

- We started a recently accepted project with our colleagues from university of Tiaret on applying artificial intelligence technologies for the study of wheat yield in the region of Tiaret.

Curricula / Updated Courses

Accredited at university and regional levels: 20 March 2021.
Accredited by the national commission at the ministry of higher education: 12 July 2021
Integrated in the official ministry list of curricula for high school bachelors: 29 June 2021

- **Agriculture**: Plant physiology, Plant biodiversity, Ecology and environment, Physiology of vegetable nutrition, Plant ecophysiology.
- **Technologies**: Introduction to Computer Science, Mathematics, Applied physics, Statistics, Data analytics, Bioinformatics, GIS for Precision Agriculture.

Curricula / New Courses

Accredited at university and regional levels: 20 March 2021.
Accredited by the national commission at the ministry of higher education: 12 July 2021
Integrated in the official ministry list of curricula for high school bachelors: 29 June 2021

- **Agriculture**: Water and water nutrition of plants, Physiology and biochemistry of symbotic fixation of nitrogen, Pedology, Agricultural irrigation technology, Vegetable production, Agricultural mechanization technology, Phytodiagnosis and phytoprotection, Fertilisation, Salty soils.

Curricula / New Courses

Accredited at university and regional levels: 20 March 2021.
Accredited by the national commission at the ministry of higher education: 12 July 2021
Integrated in the official ministry list of curricula for high school bachelors: 29 June 2021

- **Technologies**: Technological tools for Precision Agriculture, Programming and Algorithms, Information systems and web/mobile programming, Image Processing and Computer Vision, Sensor Systems for Precision Agriculture, Remote sensing, Advanced GIS Techniques for Precision Agriculture, Global Navigation Satellite Systems, Artificial intelligence, machine learning and big-data.

Curricula / Curricula description details

We have provided the core-curricula details. See the link:
https://drive.google.com/file/d/11H4TOSm602pBvhbxIhwGr1UFGs39_7J2/view?usp=sharing

Semester 1

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
UE Fundamental												
FU1 *Introduction to plan biology*	Plant physiology	**45**	70	22.5		22.5	25			4	4	
	Plant biodiversity	**45**	70	22.5		22.5	25			3	4	
	Ecology and environment	**37.5**	52.5	15	22.5		15			3	3	
FU2 *Technologies*	Technological tools for Precision Agriculture	**45**	80		22.5	22.5	35			4	4	
	Introduction to Computer Science	**45**	70	22.5		22.5	25			3	4	
U Methodology												
MU1 *Mathematics and physics*	Mathematics	**52.5**	67.5	15	22.5	15	15			3	3	
	Applied physics	**45**	60	22.5	22.5		15			3	3	
U Discovery												
UED1 *Work methods*	Fundamentals of the scientific approach	**22.5**	30		15	7.5	7.5			2	2	
U Transversal												
UET1 *Language and communication 1*	Strengthening of English language skills	**22.5**	30		15	7.5	7.5			2	1.5	
	Strengthening of language skills for communication	**22.5**	30.5		15	7.5	8			2	1.5	
	TOTAL SEMESTER	**382.5**	**560.5**	**120**	**135**	**127.5**	**178**			**29**	**30**	
	TOTAL	**943**										
	TOTAL FU	217.5	342.5	82.5	45	90	125			17	19	
	TOAL MU	97.5	127.5	37.5	45	15	30			6	6	
	TOTAL DU+TU	67.5	90.5	0	45	22.5	23			6	5	

Semester 2

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
U Fundamental												
FU1 *Physiology and Nutrition*	Physiology and biochemistry of symbotic fixation of nitrogen	**36**	51	15	0	21	15			3	3	
	Physiology of vegetable nutrition	**36**	51	15	0	21	15			4	3	
	Water and water nutrition of plants	**37.5**	52.5	15	22.5	0	15			4	3	
FU2 *Statistics and programming*	Statistics	**52.5**	61.5	15	22.5	15	9			4	3	
	Programming and Algorithms	**51**	60	15	15	21	9			4	3	
	Information systems and web/mobile programming	**36**	51	15	0	21	15			3	3	
U Methodology												
MU1 *Professions*	Knowledge of Professions	**22.5**	37.5		15	7.5	15			2	1	
	Supervised project	**22.5**	45			22.5	22.5			2	2	
	Discovery training	**0**	112				112	2		6	6	
U Transversal												
TU1 *Languages and communication 2*	Professional English 1	**22.5**	30.5		15	7.5	8			2	2	
	Introduction to communication	**22.5**	30		15	7.5	7.5			2	1	
	TOTAL SEMESTER	**339**	**582**	**90**	**105**	**144**	**243**			**36**	**30**	
	TOTAL	**921**										
	TOTAL FU	249	327	90	60	99	78			22	18	
	TOAL MU	45	194.5	0	15	30	149.5			10	9	
	TOTAL DU+TU	45	60.5	0	30	15	15.5			4	3	

Curricula / Curricula description details

We have provided the core-curricula details. See the link:
https://drive.google.com/file/d/11H4TOSm602pBvhbxIhwGr1UFGs39_7J2/view?usp=sharing

Semester 3

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
U Fundamental												
FU1 *Agricultural Ecosystems*	Pedology	**54**	74	22.5	9	22.5	20			4	4	
	Plant ecophysiology	**54**	74	22.5	9	22.5	20			4	4	
	Agricultural irrigation technology	**45**	65		22.5	22.5	20			4	3	
FU2 *Data analytics and vision*	Data analytics	**54**	74	9	22.5	22.5	20			4	4	
	Bioinformatics	**31.5**	41.5	9	22.5		10			2	2	
	Image Processing and Computer Vision	**67.5**	87.5	22.5	22.5	22.5	20			4	4	
U Methodology												
MU1 *Self-awareness and project*	Self-awareness	**9**	9			9		3		1	1	
	Supervised project 1	**22.5**	45			22.5	22.5			2	2	
U Transversal												
TU1 *Languages and communication 3*	Professional english 2	**22.5**	30		15	7.5	7.5			2	2	
	Oral communication	**22.5**	30		15	7.5	7.5			1	2	
	Introduction to business management and creation	**22.5**	30.5	16.5	6		8			2	2	
	TOTAL SEMESTER	**405**	**560.5**	**102**	**144**	**159**	**155.5**			**30**	**30**	
	TOTAL	**965.5**										
	TOTAL FU	306	416	85.5	108	112.5	110			22	21	
	TOAL MU	31.5	54	0	0	31.5	22.5			3	3	
	TOTAL DU+TU	67.5	90.5	16.5	36	15	23			5	6	

Semester 4

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
U Fundamental												
FU1 *Production and agricultural health*	Vegetable production	22.5	52.5	22.5			30			4	3	
	Phytodiagnosis and phytoprotection	45	65		22.5	22.5	20			4	3	
FU2 *GIS, sensors and remote sensing*	GIS for Precision Agriculture	45	69	22.5		22.5	24			4	3	
	Sensor Systems for Precision Agriculture	45	60		22.5	22.5	15			4	3	
	Remote sensing	60	75	15	22.5	22.5	15			3	3	
U Methodology												
MU1 *Projet management*	Decision in project management	9	39			9	30	3		2	2	
	Internship	0	224				224	3		9	9	
U Transversal												
TU1 *Languages, communication and companies*	Professional english 3	22.5	30		15	7.5	7.5			2	1.5	
	Written communication	22.5	30		15	7.5	7.5			1	1.5	
	Deepening in the management and creation of companies	22.5	32.5	12	10.5		10			1	1	
	TOTAL SEMESTER	**294**	**677**	**72**	**108**	**114**	**383**			**34**	**30**	
	TOTAL	**971**										
	TOTAL FU	217.5	321.5	60	67.5	90	104			19	15	
	TOAL MU	9	263	0	0	9	254			11	11	
	TOTAL DU+TU	67.5	92.5	12	40.5	15	25			4	4	

Curricula / Curricula description details

We have provided the core-curricula details. See the link:
https://drive.google.com/file/d/11H4TOSm602pBvhbxIhwGr1UFGs39_7J2/view?usp=sharing

Semester 5

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
UE Fundamental												
FU1 *Agricultural Technologies*	Fertilisation	**46.5**	66.5	9	22.5	15	20			4	3	
	Salty soils	**46.5**	66.5	22.5	9	15	20			3	3	
	Agricultural mechanization technology	**45**	70	22.5	22.5		25			4	4	
FU2 *GIS, GNSS and machine learning*	Advanced GIS Techniques for Precision Agriculture	**54**	74	22.5	9	22.5	20			4	4	
	Global Navigation Satellite Systems	**54**	74	9	22.5	22.5	20			3	4	
	Artificial intelligence, machine learning and big-data	**45**	65	22.5		22.5	20			3	3	
U Methodology												
MU1 *Project and business*	Supervised project 2	**22.5**	45			22.5	22.5			3	3	
	Application to business management and creation	**22.5**	32.5	3	19.5		10			2	2	
U Transversal												
TU1 *Languages and communication 4*	Professional English 4	**22.5**	30		15	7.5	7.5			2	2	
	Professional communication	**22.5**	30		15	7.5	7.5			1	2	
	TOTAL SEMESTER	**381**	**553.5**	**111**	**135**	**135**	**172.5**			**29**	**30**	
	TOTAL	**934.5**										
	TOTAL FU	291	416	108	86	98	125			21	21	
	TOAL MU	45	77.5	3	20	23	32.5			5	5	
	TOTAL DU+TU	45	60	0	30	15	15			3	4	

Semester 6

Units	Courses	Total presential	Total student	LE	TU	PW	Personal Work	H. coach / stud.	H. coach / group stud.	Coeff	Credits	C : continu R : writ. rep. D : defense
U Fundamental												
FU1		**0**	0	0						0	0	
		0	0	0						0	0	
U Methodology												
MU1 *Final project*	Final projet	**0**	200				200		16	9	9	
	Internship on precision agriculture	**0**	420				420	5		21	21	
U Transversal												
		0	0									
		0	0									
	TOTAL SEMESTER	**0**	**620**	**0**	**0**	**0**	**620**			**30**	**30**	
	TOTAL	**620**										
	TOTAL UEF	0	0							0	0	
	TOAL UEM	0	620							30	30	
	TOTAL UED+UET	0	0							0	0	

Curricula / Teaching materials

1. Data analysis and learning, (Dr. Noureddine Aribi, Pr. Loukil Loukil, Ms. Said Fourour)
2. Plant physiology (Pr BELKHODJA Moulay, Dr. ACHOUR Asma)
3. Programming and Algorithms – Python (Dr. Noureddine Aribi, Pr. Loukil Loukil, Ms. Said Fourour)
4. Statistics (Pr. Yahia Lebbah)
5. Statistics - practical works with R (Pr. Yahia Lebbah, Dr. Miloud Dahane)
6. Technological tools for Precision Agriculture (Pr. Yahia Lebbah)
7. Fundamentals of the scientific approach (Dr KADIRI Amina)
8. Remote sensing (Dr. Noureddine Aribi)
9. Data analytics (Pr. Lakhdar Loukil, Dr. Mohammed Sayah, Ass. Said Fourour)
10. GIS for Precision Agriculture (Pr. Noureddine Benaissa)
11. Programming and Algorithms (Ass. Said Fourour, Dr. Noureddine Aribi)
12. Sensor Systems for Precision Agriculture (Dr. Amine Dahane)
13. Information systems and web programming (Dr. Noureddine Aribi)
14. Introduction to Computer Science (Dr. Miloud Dahane)

Curricula / Bachelor curriculum renewed 2022

- **This new year 2022/2023:**
  - **31 new students** will fulfil our bachelor curricula on precision agriculture.

- Wednesday 28th September, a mini-seminar done by Cupagis working group towards students on PA.

Curricula / Pilot teaching

In Algeria, pilot teaching is difficult to perform in the context of current regulations.

The usual way in Algeria to propose a new curriculum is in three steps:

1. Design the curriculum in a document detailing all of the content of the courses, semesters, ECTS, …
2. Submit and get the approval of the curriculum from the national commission at the ministry of higher education.
3. Launch the curriculum and revise its content continuously at the national commission.

We have already finalized the content of our new curriculum on precision agriculture in 2020/2021 reports. (See the final document in French)

Once the curriculum approved by the ministry of higher education, we can consider the first students group following the curriculum as a pilot teaching.

Curricula / Pilot teaching / Bachelor curriculum launched

- Local approve at the university (see link of the approving document).
- Curricula approved by the national commission (see link).

We have two promotions of students:

- First promotion 2021:
  - 14 students are following the second year of the Bachelor training on PA.
- Second promotion 2022:
  - 31 students are following the first year of the Bachelor training on PA.
- Amount of the courses with ECTS, involved in the pilot teaching: 30*6
- Number of teachers involved in the pilot teaching: 14 teachers on plant biology, 11 teachers on technologies.

- We will periodically peer-review the curricula. Surely, in three years, we will process an official revise of the whole curricula.

Quality assurance

- One peer review from the national commission to get agreement to launch our new curricula.
- Peer review asked about the arguments to get the “professional” label for our curricula.
- We argued by the numerous agreements we made with many professional stakeholders.
- Got the national agreement 2021 July 12.

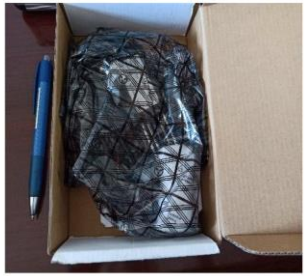
Laboratories / Equipment retrieve+dispatch

In 2022, Oran1 university fulfilled the sub-task of retrieving the second set of equipment from Algiers airport, then partitioned the items into 5 parts. Each university got his equipment.

This second set of equipment contains:

- JETI Spectral 1501NIR Spectroradiometer (350 nm-1000 nm)
- LaQuinta Professional Multispectral Camera
- Soil N.P.K. Tester
- RS485 5Pin Soil NPK Temperature and Humidity EC Sensor





Laboratories / CUPAGIS laboratory

Computers installed in the VCR space

Field where we will deploy received sensors

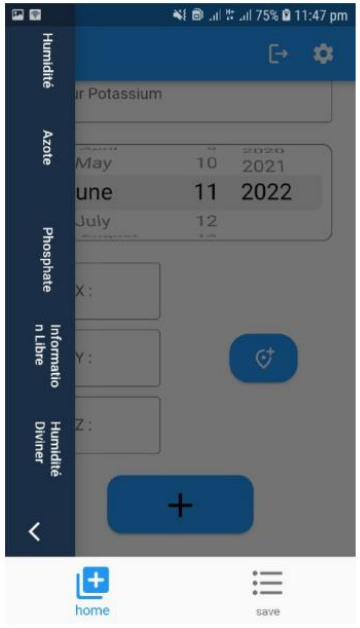
Laboratories / CUPAGIS laboratory / Computers

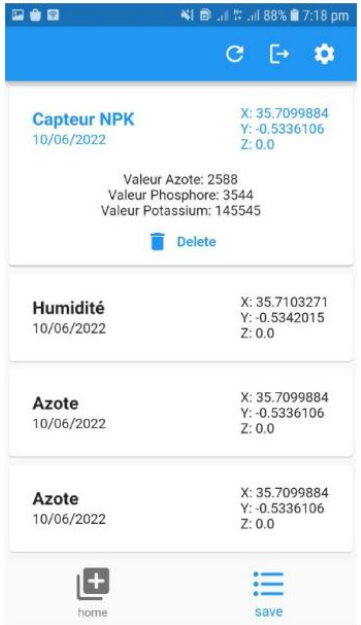
Computers installed in the VCR space, exploited
in the end of the first semester
and fully in the second semester 2022

Laboratories / CUPAGIS laboratory

We have started exploiting the received sensors, which will be used in the courses dedicated to sensing technologies. Teachers are finishing the manuals explaining how to install and exploit these sensors.

Laboratories / CUPAGIS laboratory / Data





With a collaboration with computer science department:

- Ongoing interface software development to input data from sensors
- Ongoing server software development to be installed in data-server

Laboratories / CUPAGIS laboratory - Courses

CUAPGIS laboratory

LABORATORY	SEMESTER	COURSE	TEACHERS
VCR space	S1	- Technological tools for Precision Agriculture - Introduction to Computer Science	Pr BELKHODJA Moulay + Pr. LEBBAH Yahia + Pr. BENAISSA Noureddine Dr. DAHANE Miloud
	S2	- Statistics - Programming and Algorithms - Information systems and web/mobile programming	Pr. LEBBAH Yahia As. FOUROUR Said Dr. ARIBI Noureddine
	S3	- Data analytics - Bioinformatics - Image Processing and Computer Vision	Pr. LOUKIL Lakhdar Dr. AMOURI Adal Amar Dr. SAYAH Mohamed
	S4	- GIS for Precision Agriculture - Sensor Systems for Precision Agriculture - Remote sensing	Pr. BENAISSA Noureddine + Ms. KHALFAOUI Houria + Dr. SAYAH Mohamed Dr. Dahane Amine Dr. ARIBI Noureddine
	S5	- Advanced GIS Techniques for Precision Agriculture - Global Navigation Satellite Systems - Artificial intelligence, machine learning and big-data	Pr. BENAISSA Moussa Pr. KADDOUR Mejdi Pr. LOUKIL Lakhdar + Dr. ARIBI Noureddine + Pr. LEBBAH Yahia

CUAPGIS laboratory

LABORATORY	SEMESTER	COURSE	TEACHERS
PAGIS space	S1	- Technological tools for Precision Agriculture	Pr BELKHODJA Moulay + Pr. LEBBAH Yahia + Pr. BENAISSA
	S4	- Sensor Systems for Precision Agriculture - Remote sensing	Dr. Dahane Amine Dr. ARIBI Noureddine
	S5	- Advanced GIS Techniques for Precision Agriculture	Pr. BENAISSA Noureddine + Ms. KHALFAOUI + Dr. SAYAH Mohamed

Laboratories / Existing laboratories

Existing laboratories

LABORATORY	SEMESTER	COURSE	TEACHERS
Vegetable physiology Laboratory	S1	- Plant physiology	Pr BELKHODJA Moulay + Dr ACHOUR Asma
		- Technological tools for Precision Agriculture	Pr BELKHODJA Moulay
	S2	- Water and water nutrition of plants	Pr BELKHODJA Moulay+ Dr ACHOUR Asma
		- Physiology of vegetable nutrition	Dr BIDAI Yasmina
	S3	- Pedology	Dr BIDAI Yasmina
		- Plant ecophysiology	Pr BELKHODJA Moulay
		- Agricultural irrigation technology	Pr BELKHODJA Moulay
	S4	- Vegetable production	Dr BENLALDJ Amel
	S5	- Fertilisation	Dr BIDAI Yasmina+
		- Salty soils	Dr ACHOUR Asma
		- Agricultural mechanization technology	Pr BELKHODJA Moulay
Plant biology Laboratory	S2	- Physiology of vegetable nutrition	Pr IGHIL HARIZ Zohra
		- Physiology and biochemistry of symbotic fixation of nitrogen	Pr IGHIL HARIZ Zohra + Dr KADIRI Amina
Vegetable ecology Laboratory	S1	- Ecology and environment	Dr HALFAOUI Yamina + Dr BENLALDJ Amel
		- Plant biodiversity	Dr BELASKRI Asma
Biotechnology Laboratory	S1	- Applied physics	Pr BENAISSA Noreddine
	S4	- Phytodiagnosis and phytoprotection	Pr HADDAD Fatima Zohra+ Pr BENAISSA Noreddine

Dissemination

- Presentations of CUPAGIS results in events organized by CBHE SEED4NA project.
- Four presentations at the final Cupagis master classes
- Presentation at Erasmus Days Oran1 university
- Brochure for high schools students to introduce our new bachelor curricula on precision agriculture.
  https://vrre.univ-oran1.dz/images/docs-telecharger/Brochure_AP.pdf

Dissemination / events organized by CBHE SEED4NA project

- 2022-03-28
  Presentation of the Bachelor training on precision agriculture developed in Cupagis
  Dr. Noureddine Aribi
- 2022-04-27
  Applications of GI/EO/AI in Precision Agriculture
  Dr. Noureddine Aribi
- 2022-09-12
  Remote Sensing - New Course developed in Cupagis project
  Dr. Noureddine Aribi

Dissemination / Cupagis master classes and final conference

2022-09-25 to 2022-10-03

- L'AGRICULTURE DE PRECISON / UNE ALTERNATIVE POUR REHABILITER LE SECTEUR AGRAIRE EN ALGERIE (in French)
  Pr. Moulay Belkhodja
- MÉTABOLISME SECONDAIRE CHEZ LES VÉGÉTAUX (in French)
  Pr. Fatima Zohra Haddad
- Introduction to GIS
  Pr. Noureddine Benaissa
- Modernized Learning and Teaching methodologies - Application to Remote Sensing Course
  Dr. Noureddine Aribi
- Oran1 Cupagis project report restitution
  Pr. Yahia Lebbah

Dissemination / Erasmus days

- Erasmus days 2022-10-10 animated by Pr. Yahia Lebbah
  Design of a bachelor curriculum on precision agriculture
  https://vrre.univ-oran1.dz/erasmus+/fr/2-uncategorised/82-erasmus-days-2022.html

Dissemination / Cupagis Oran1 on youtube

- We have created a youtube channel “Cupagis Oran”: https://www.youtube.com/channel/UCawyxkqa8HNO3TMB3-m291w

- Continuously updated Facebook page to disseminate Cupagis activities https://www.facebook.com/Cupagis-Oran1-University-454383688459311

Sustainability of PASENSO Offices

Main agreements with non-academic stakeholders:

- DSA Oran - Agricultural Services Management of the District of Oran (Direction des services agricoles de la wilaya d'Oran)
- ITCM Hassi-Bounif - Oran - Technical Institute of Vegetable Crops (Institut technique des cultures maraîchères)
- Algerian Centre for Space Technologies (CTS/ASAL)

Developed complete practical trainings:

- Programming and Algorithms with Python
  https://drive.google.com/file/d/1_ZMzrA8OYDNjY4Y7olX0iRr5RV1NIVZY/view?usp=sharing
- Statistics
  https://drive.google.com/file/d/1ePXzKVqUl82ye2__E985XSo-Gmx02bIX/view?usp=sharing
- Data analysis and machine learning
  https://drive.google.com/file/d/1zKfvcWdJxwX9SyhSvz2y3zychrVpo1Kq/view?usp=sharing

Sustainability of PASENSO Office




Students visiting public and private agricultural entities

Conclusion

- Main result: **Bachelor curriculum on Precision Agriculture**
  - 2 promotions of motivated students on agriculture
  - Equipment
  - VCR room for teaching with computers
  - Sensors equipment

- Next steps:
  - Finalizing the experimental field preparation
  - Pasenso to be developed by showing precision agriculture on our experimental field to stakeholders

Thank you for you attention!

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Co-funded by the
Erasmus+ Programme
of the European Union