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Association rules with SIA in B-Learning Courses: A mapping review

3. Blended learning: Experiences in search of quality

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Abstract: According to scopus between the years 2012 and 2016 there are 3556 scientific documents about Blended Learning, these have been and are still an emerging learning methodology. With this document, we determine the association rules with statistical implicative analysis (SIA) in B-Learning courses in Science Faculty at the ESPOCH University. To this end, we use mapping review in the blended learning courses used in the last 5 years (2012 to 2016) in Institutional platform, milaulas.com, and google. We started with 3350 B-Learning courses and finally 13 had all quality criteria. This document also describe a Institutional experience about Association rules with SIA in B-Learning Courses in the last five years.

Keywords: statistical implicative analysis, systematic review, university, blended learning, extracting knowledge in statistics

INTRODUCTION

The idea of association rules with Statistical Implicative Analysis (SIA) was conceived for Regis Gras [5] forty-eight years ago and has a set of data analysis tools that allows approaching knowledge on the basis of the information contained in the statistic database. The approach is performed starting from the generation of asymmetric rules [26] between variables and variables classes. The statistical theory [2] and application of SIA are in continuous expansion and development. The SIA informatics tool is called CHIC [3; 4], the last windows version is 7.x, the CHIC free

multiplatform version is called RCHIC and has been used since 2014[14]. SIA has an international group of active researchers from 2000[15].

The aim of this paper is to describe Association rules with SIA in B-Learning Courses in last 5 years in Science Faculty at the ESPOCH University.

The Espoch is a public university, which is in the city of Riobamba-Ecuador. The Espoch have 7 Faculties: faculty of business administration, faculty of livestock sciences, faculty of computers and electronics, faculty of mechanics, faculty of natural resources, faculty of public health and faculty of sciences.

The science faculty, have four schools and six careers: Biophysics, Informatics statistic, Chemistry, Chemistry engineering, Biochemistry-pharmacy and Environmental biotechnology. All professional careers are face-to-face and supported by Blended learning in moodle platform [6; 14; 1].

Since 2013, espoch initiated a training process in the use of association rules [10] in the extraction of knowledge through Statistical Implication Analysis. This work also aims to know the sustainability of the training process carried out.

Section II describes the mapping review of literature and the steps in the research realized. Section III describes the results and its discussion. Finally, section IV describes the conclusions.

METHOD

In the planning of systematic and mapping review the objectives were identified and the protocol was defined [7]. In planning the objectives were identified and defined the protocol [8]. The Protocol shows the method used in the systematic review and mapping in order to minimize the bias of researchers and that the methodology can be reproduced. Below we summarize the protocol used:

Research questions

The systematic mapping aims to answer the questions:
MQ0: What is the number of B-learning papers in the last 5 years?
MQ1: What is the number of B-learning courses by semester?
MQ2: What is the number of B-learning courses by career?
MQ3: What is the percentage of B-learning courses in statistics by semester?
MQ4: What B-learning courses using Association rules ?
MQ5: What B-learning courses using Association rules with SIA?
MQ6: What software using in Association rules with SIA?

PICOC method

The paper of Petticrew and Roberts [9], proposed the PICOC method to define our scope:

- Population (**P**): B-learning Courses using SIA in Cience Faculty (2012-2016).
- Intervention (**I**): SIA B-learning Courses with explicit SIA contens, in last five years (2012-2016).
- Comparison (**C**): No comparison intervention.
- Outcomes (**O**): Association rules with SIA, main results

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[14] http://members.femto-st.fr/raphael-couturier/en/rchic
[15] http://sites.univ-lyon2.fr/asi9/

▪ Context(**C**): SIA B-learning Courses in Cience Faculty

Time period

The last 5 years (2012 to 2016)

Sources

The search was done in the next web pages

▪ Institutional Moodle(https://elearning.espoch.edu.ec/),
▪ milaulas (https://www.milaulas.com/),
▪ Google (https://www.google.com.ec),

In order to answer the research questions raised, the inclusion and exclusion criteria were defined, they also allowed us to select the B-Learning courses based in Association rules .

Inclusion and exclusion criteria

The inclusion criteria (IC) are presented below:

IC1: The B-learning courses are used in Science Faculty careers
IC2: The B-learning courses, were implemented in moodle platform
IC3: The moodle platform can be institutional or not
IC4: Association rules with SIA was studied at least in 10%

The exclusion criteria [11] are presented below:
EC1: The B-learning courses are used in other ESPOCH Faculties
EC2: The B-learning courses, were implemented not moodle platform
EC3: The B-learning courses, were not accessible

Search string

The group of primary studies were defined [54]. The final search string was described as follows: ("statistical implicative analysis" OR SIA) AND (LIMIT-TO (PUBYEAR, 2016) OR (LIMIT-TO (PUBYEAR, 2015) OR (LIMIT-TO (PUBYEAR, 2014) OR (LIMIT-TO (PUBYEAR, 2013) OR (LIMIT-TO (PUBYEAR, 2012)) [12; 13] showed studies on control, if the search chain found relevant studies.

Quality assessment

The quality assessment questions are presented below in Table 1:

Table 1: Quality assessment questions

Questions	Answers		
	Yes=1	*No=0*	*Half=0.5*
1. Are the B-learning course goals clearly specified?			
2. Are the Statistical Implicative Analysis goals clearly specified?			
3. Are the Association rules with SIA goals clearly specified?			
4. Was the b-learning methodology used for less than 70% of the course?			
5. Was the b-learning methodology used with all students?			

RESULTS AND DISCUSION

MQ0: What is the number of B-learning papers in the last 5 years?
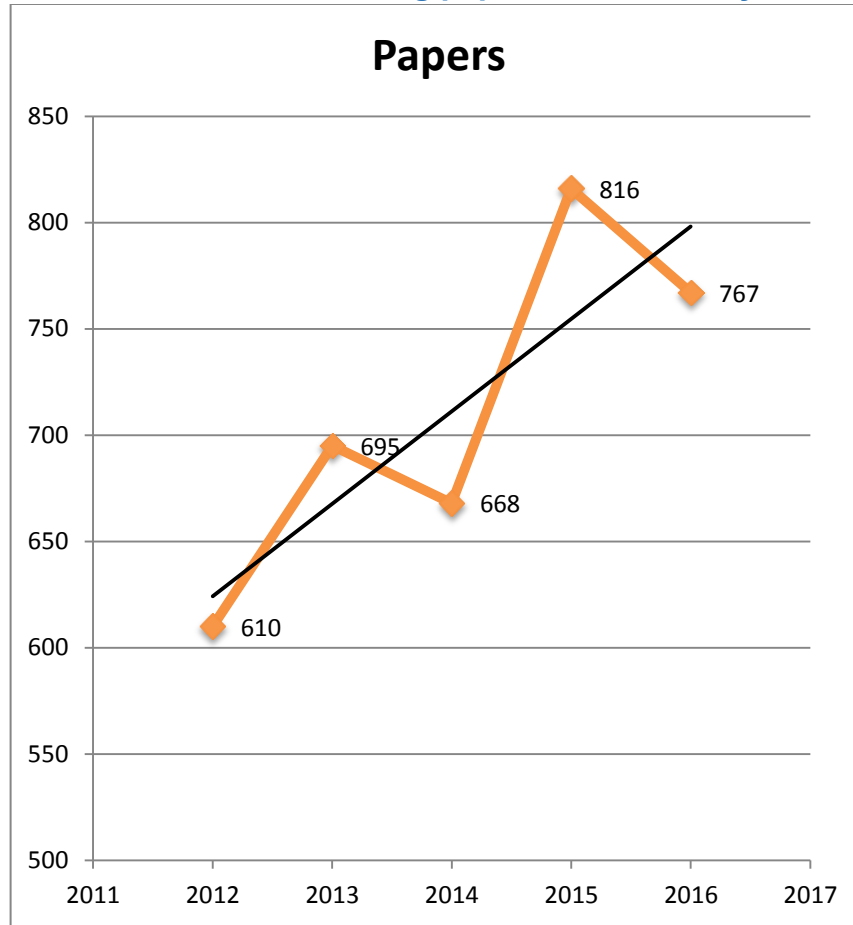
Papers

Figure 1: Blended Learning Papers By Year

Figure 1. Shows the tendency of B-learning papers, in general they tend to increase. This is because; they have been and are still an emerging learning methodology.

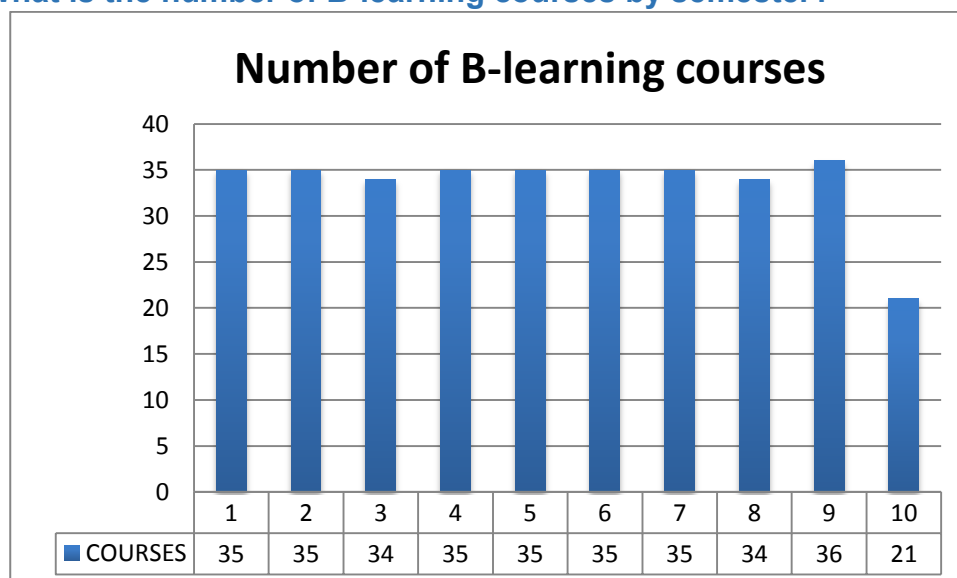**MQ1: What is the number of B-learning courses by semester?**

Number of B-learning courses

	1	2	3	4	5	6	7	8	9	10
■ COURSES	35	35	34	35	35	35	35	34	36	21

Figure 2: Bar Char about number of B-learning courses by Semester (10 semesters in 5 years)

The figure 2, can be expanded as follow, in 5 years there are 10 semesters, total   = 335 * 10 = 3350 moodle courses.

MQ2: What is the number of B-learning courses by career?

Table 2: B-learning courses by career

Biofísica	50
Bioquímica y Farmacia	56
Ing. Biotecnología Ambiental	61
Ing. Estadística Informática	50
Ing. Química	62
Química	56
Total	335

The Table 2, can be expanded as follow, in 5 years there are 10 semesters, total = 335 * 10 = 3350 moodle courses.

MQ3: What is the percentage of B-learning courses in statistics by semester?
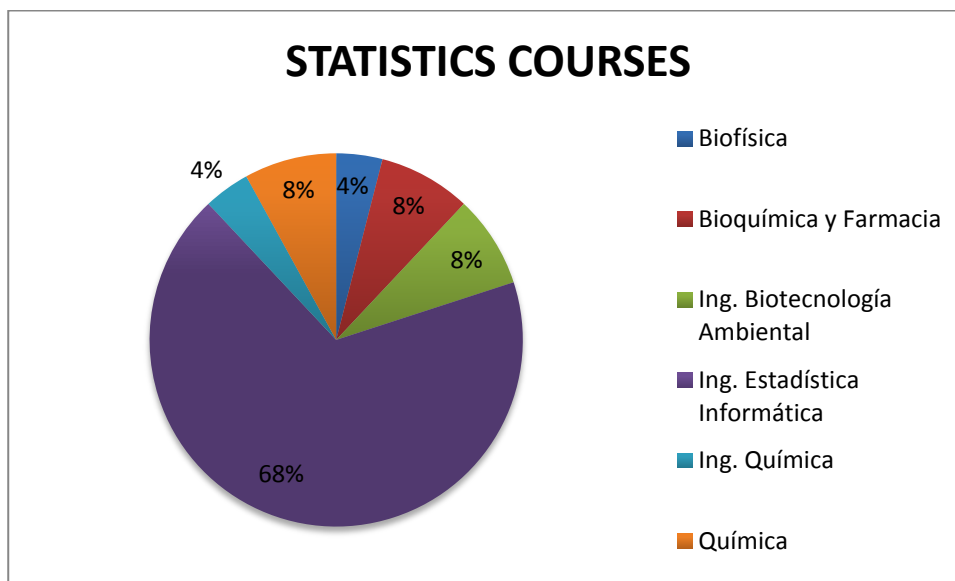

Figure 3: B-learning courses in statistics by semester?

Figure 3. Shows that the most frequent carrier is Informatics statistic (68.0 %), because the carrier is specialized en statistics.

MQ4: What B-learning courses using Association rules ?

Table 3: B-learning courses using Association rules, SIA and Software

YEAR	PERIOD	SCHOOL	CARRIER	SEMESTER	COURSE	WEEKLY HOURS	SOFTWARE
2012	MAR-AGO	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	CHIC
2012	SEP-FEB	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	CHIC
2013	MAR-AGO	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	CHIC
2013	SEP-FEB	Ciencias Químicas	Ing. Biotecnología Ambiental	9	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	CHIC
2013	SEP-FEB	Bioquímica y Farmacia	Bioquímica y Farmacia	7	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	CHIC
2013	SEP-FEB	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	CHIC
2014	MAR-AGO	Ciencias Químicas	Ing. Biotecnología Ambiental	9	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	RCHIC
2014	MAR-AGO	Bioquímica y Farmacia	Bioquímica y Farmacia	7	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	RCHIC
2014	MAR-AGO	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	RCHIC
2014	SEP-FEB	Ciencias Químicas	Ing. Biotecnología Ambiental	9	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	RCHIC
2014	SEP-FEB	Bioquímica y Farmacia	Bioquímica y Farmacia	7	BIOMETRIA Y DISEÑO EXPERIMENTAL	6	RCHIC
2014	SEP-FEB	Física y Matemática	Ing. Estadística Informática	7	ESTADISTICA NO PARAMETRICA	8	RCHIC
2015	MAR-AGO	Física y Matemática	Ing. Estadística Informática	6	SIE APLICADAS A LA INVESTIGACION	12	RCHIC
2015	SEP-FEB						
2016	MAR-AGO						
2016	SEP-FEB			:			

Table 3 shows that 3 b-learning courses were using the association rules. The courses were: estadística no paramétrica, biometría y diseño experimental, sistemas de información estadísticos aplicados a la investigación. These courses were repeated for three consecutive years (six semesters)

MQ5: What B-learning courses using Association rules with SIA?
Table 3 shows that 3 b-learning courses were using the association rules with Statistical Implicative Analysis. The courses were: estadística no paramétrica, biometría y diseño experimental, sistemas de información estadísticos aplicados a la investigación. These courses were repeated for three consecutive years (six semesters) and were the following schools Informatics statistic, Biochemistry-pharmacy and Environmental biotechnology.

MQ6: What software using in Association rules with SIA?
Table 3 shows that there are two different software used CHIC and RCHIC, in the first six semesters was used CHIC and the next seven semesters was used RCHIC. The use of CHIC or RCHIC seems to depend only on time.

CONCLUSIONS

The aim of this paper is to describe Association rules with SIA in B-Learning Courses in last 5 years in Science Faculty at the ESPOCH University. To describe Association rules with SIA in B-Learning Courses, we use mapping literature review method. The tendency of B-learning papers is to increase in the time, Statistical Implicative Analysis can be used for Learning analytics in particular for Moodle. The number of B-learning courses by Semester has a mean of 34 courses in Science Faculty. The carrier with more courses of B-learning is Chemistry Engineering. The most frequent carrier is Informatics statistic (68.0 %), because the carrier is specialized en statistics. Three b-learning courses were using the association rules with Statistical Implicative Analysis and were repeated for three consecutive years (six semesters). In the first six semesters was used CHIC and the next seven semesters was used RCHIC, because RCHIC was develop in the ESPOCH University around the year 2014 by Rafael Couturier. We can conclude that there is a development of the SIA in the years 2013 and 2014, but that since 2015 there is stagnation.

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CURRÍCULUM

Rubén Pazmiño is preparing his Ph. thesis in Learning Analytics and Statistical implicative Analysis at Salamanca University, Spain. He received his bachelor of Mathematics in the Escuela Superior Politécnica de Chimborazo (ESPOCH) University, Riobamba, Ecuador. He received a master degree in education and computer science in the University of Los Lagos, Osorno, Chile and he also received his master in educational research in the UNL University, Loja, Ecuador. He is a principal professor at ESPOCH University. Rubén Pazmiño has created the Statistic school, the Biofisic School, mathematical modeling master degree and he is working to created a master in Data Science. His research interests include Data Science, educational data mining, learning analytics, statistical implicative analysis and computational statistics. He has authored or co-authored of some papers.