VIRTUAL LEARNING ENVIRONMENT DATASET ANALYSIS REPORT

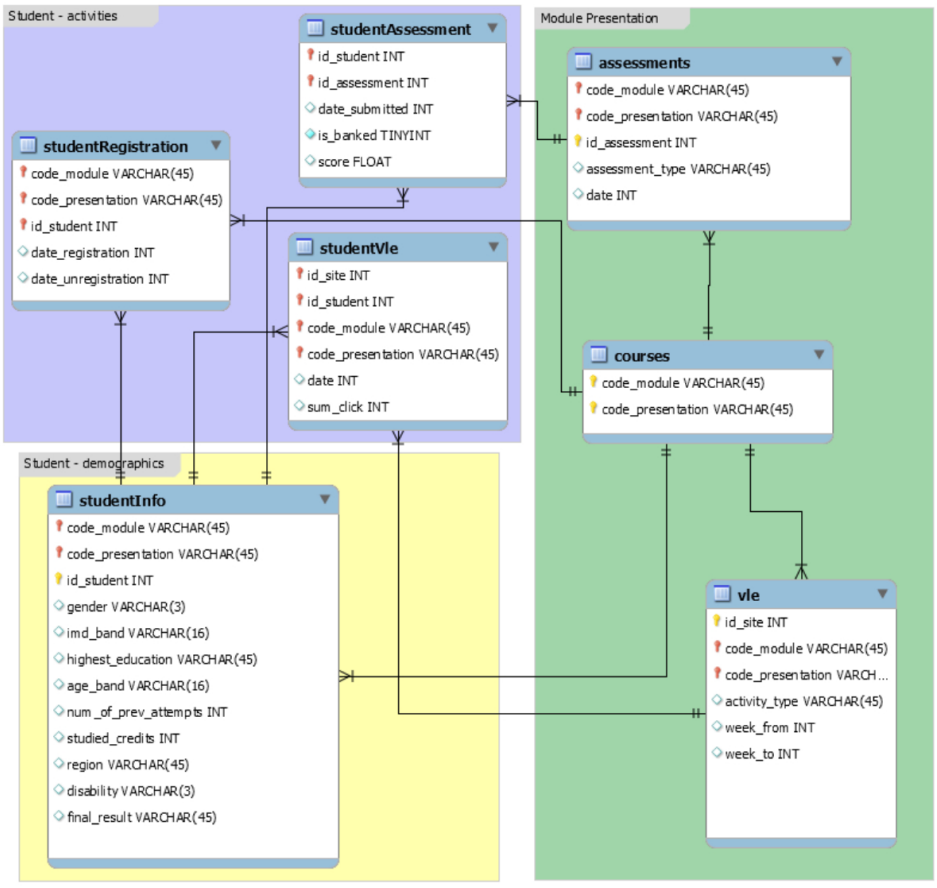
Author: Dao Le Bao Thoa

Year: 2021

Overview

1. Describing and analyzing OULAD Virtual Learning Environment dataset.
2. Processing and cleaning data.
3. Making insight.
4. Conclusion.

1. Describing and analyzing OULAD Virtual Learning Environment dataset.



Explaination schema:

- **code_module** code name of the module, which serves as the identifier.
- **code_presentation**- code name of the presentation. It consists of the year and “B” for the presentation starting in February and “J” for the presentation starting in October.
- **length**- length of the module-presentation in days.

```
    Note: The structure of B and J presentations may differ and therefore it is good practice to analyse the B and J
presentations separately. Nevertheless, for some presentations the corresponding previous B/J presentation do not ex
```

```
ist and therefore the J presentation must be used to inform the B presentation or vice versa. In the dataset this is
the case of CCC, EEE and GGG modules.
```

- **id_assessment**- identification number of the assessment.
- **assessment_type**- type of assessment. Three types of assessments exist: Tutor Marked Assessment (TMA), Computer Marked Assessment (CMA) and Final Exam (Exam).
- **date**- information about the final submission date of the assessment calculated as the number of days since the start of the module-presentation. The starting date of the presentation has number 0 (zero).
- **weight**- weight of the assessment in %. Typically, Exams are treated separately and have the weight 100%; the sum of all other assessments is 100%.
- **id_site**- an identification number of the material.
- **activity_type** – the role associated with the module material.
- **id_student** – a unique identification number for the student.
- **gender** – the student's gender.
- **region** – identifies the geographic region, where the student lived while taking the module-presentation.
- **highest_education** – highest student education level on entry to the module presentation.
- **imd_band** – specifies the Index of Multiple Depravation band of the place where the student lived during the module-presentation.
- **age_band** – band of the student's age.
- **num_of_prev_attempts** – the number times the student has attempted this module.
- **studied_credits** – the total number of credits for the modules the student is currently studying.
- **disability** – indicates whether the student has declared a disability.
- **final_result** – student's final result in the module-presentation.
- **date_registration** – the date of student's registration on the module presentation, this is the number of days measured relative to the start of the module-presentation (e.g. the negative value -30 means that the student registered to module presentation 30 days before it started).
- **date_unregistration** – date of student unregistration from the module presentation, this is the number of days measured relative to the start of the module-presentation. Students, who completed the course have this field empty. Students who unregistered have Withdrawal as the value of the final_result column in the studentInfo.csv file.
- **date_submitted** – the date of student submission, measured as the number of days since the start of the module presentation.
- **score** – the student's score in this assessment. The range is from 0 to 100. The score lower than 40 is interpreted as Fail. The marks are in the range from 0 to 100.
- **date** – the date of student's interaction with the material measured as the number of days since the start of the module-presentation.
- **sum_click** – the number of times a student interacts with the material in that day.

Base on the information about dataset on the website, there are seven table and divide into 3 groups. Using Python version 3.8.1 and and Pandas Package version 1.2.4 extract and analyze each table:

- **Courses** (courses.csv):
  - Table size: (22, 3)
  - Table columns information: ['code_module' , 'code_presentation', 'module_presentation_length']
  - Checking duplicated values: None

Table course

	code_module	code_presentation	module_presentation_length
11	DDD	2014B	241
19	GGG	2013J	261
0	AAA	2013J	268
1	AAA	2014J	269
6	CCC	2014J	269

- **Student information** (studentInfo.csv):
  - Table size: (32593, 12)
  - Table columns information: ['code_module', 'code_presentation', 'id_student', 'gender', 'region', 'highest_education', 'imd_band', 'age_band', 'num_of_prev_attempts', 'studied_credits', 'disability', 'final_result']
  - Checking duplicated values:
    - The number of values that student take more than 1 course: 3808
    - The number of values that student take more than 1 course in the same presentaion: 1081
    - The number of values that student take a course more than 1 time: 1309

Table: Student information

	code_module	code_presentation	id_student	gender	region	highest_education	imd_band	age_band	num_of_prev_attempts	studied_credits	disabil
28634	FFF	2014J	639522	M	South East Region	A Level or Equivalent	30-40%	0-35	0	90	
16863	DDD	2014B	591654	M	North Region	A Level or Equivalent	10-20	0-35	0	60	
27952	FFF	2014J	397219	M	Scotland	HE Qualification	20-30%	0-35	0	60	
13947	DDD	2013B	547897	F	Scotland	Lower Than A Level	40-50%	0-35	0	90	
20494	EEE	2014B	407428	M	West Midlands Region	Lower Than A Level	30-40%	0-35	0	60	

- **Assessments** (assessments.csv):
  - Table size: (206, 6)
  - Table columns information: ['code_module', 'code_presentation', 'id_assessment', 'assessment_type', 'date', 'weight']
  - Checking duplicated values: None

Table: Assessments

	code_module	code_presentation	id_assessment	assessment_type	date	weight
190	GGG	2014B	37432	CMA	222.000000	0.000000
156	FFF	2014B	34896	CMA	227.000000	0.000000
180	GGG	2013J	37422	CMA	229.000000	0.000000
29	BBB	2013J	14996	TMA	19.000000	5.000000
205	GGG	2014J	37444	Exam	229.000000	100.000000

- **Student assessment** (studentAssessment.csv):
  - Table size: (173912, 5)
  - Table columns information: ['id_assessment', 'id_student', 'date_submitted', 'is_banked', 'score']
  - Checking duplicated values: None

Table: Student Assessments

	id_assessment	id_student	date_submitted	is_banked	score
25386	15005	579549	133	0	60.000000
58341	24295	689759	21	0	44.000000
97329	30710	594246	65	0	89.000000
125428	34879	595655	109	0	96.000000
17940	14998	590360	95	0	57.000000

- **Student Registration** (studentRegistration.csv):
  - Table size: (32593, 5)
  - Table columns information: ['code_module', 'code_presentation', 'id_student', 'date_registration', 'date_unregistration']
  - Checking duplicated values:
    - The number of values that student register more than 1 courses: 3808
    - The number of values that student register more than 1 courses in the same semester: 1081
    - The number of values that student register a course more than 1 time: 1309

Table: Student registration

	code_module	code_presentation	id_student	date_registration	date_unregistration
28188	FFF	2014J	558764	-10.000000	nan
14358	DDD	2013B	2629511	-73.000000	-25.000000
11792	CCC	2014J	608983	-22.000000	17.000000
10506	CCC	2014B	2410459	-29.000000	nan
30318	GGG	2013J	574238	-148.000000	nan

- **Student Vle** (studentVle.csv):
  - Table size: (10655280, 6)
  - Table columns information: ['code_module', 'code_presentation', 'id_student', 'id_site', 'date', 'sum_click']
  - Checking duplicated values:
    - Students interact to the material in the virtual learning environment: Many

Table: Student virtual learning environment

	code_module	code_presentation	id_student	id_site	date	sum_click
5011901	DDD	2014J	147328	813708	89	2

7005134	FFF	2013B	467725	527230	162	1
535943	BBB	2013B	555930	542864	60	12
4665463	DDD	2014B	612136	772705	177	10
3720891	DDD	2013J	580468	673537	-1	1

- **Vle** (vle.csv):
  - Table size: (6364, 6)
  - Table columns information: ['id_site', 'code_module', 'code_presentation', 'activity_type', 'week_from', 'week_to']
  - Checking duplicated values: None

Table: virtual learning environment material

	id_site	code_module	code_presentation	activity_type	week_from	week_to
327	877236	AAA	2014J	resource	nan	nan
608	543281	BBB	2013B	resource	nan	nan
318	877396	AAA	2014J	url	nan	nan
1024	704157	BBB	2013J	resource	nan	nan
4664	716295	FFF	2013J	oucontent	11.000000	11.000000

```
In conclusion, We devide 7 tables into 3 groups in order that it is easy to make analyzing and insight.
```

2. Processing and cleaning data.

2.1 Processing data about courses:

- Input tables:
  - Course
  - Assessment
  - Student assessment
  - Student information
  - Student registration
- Method: using pandas api **groupby**, **merge** to group and create new table, use api **drop** to clear null value and **rename** some columns.
- Output table:
  - Course information (df_course_info):
    - Table size: (22,13)
    - Table columns: ['code_module', 'code_presentation', 'module_presentation_length', 'num_of_assessment', 'avg_score', 'students_take_exam', 'num_of_student', 'Pass', 'Fail', 'Withdrawn', 'Distinction', 'num_of_soon_regis', 'num_of_unregis']
    - Checking duplicated values: None

Table 1: Course information

	code_module	code_presentation	module_presentation_length	num_of_assessment	avg_score	students_take_exam	num_of_student	Pass	Fail	Withdrawn
0	AAA	2013J	268	6	69.448600	326.600000	383	258	45	6(
1	AAA	2014J	269	6	68.631236	303.200000	365	229	46	6(
2	BBB	2013J	268	12	78.982208	1306.818182	2237	896	521	64
3	BBB	2014J	262	6	66.123764	1481.600000	2292	972	391	74
4	BBB	2013B	240	12	79.132027	1023.272727	1767	648	459	50
5	BBB	2014B	234	12	78.912318	908.454545	1613	561	396	49(
6	CCC	2014J	269	10	74.501944	1272.333333	2498	709	406	107
7	CCC	2014B	241	10	71.527308	832.111111	1936	471	375	89
8	DDD	2013J	261	7	68.729022	1133.714286	1938	731	428	68
9	DDD	2014J	262	7	70.831078	1144.714286	1803	680	364	64
10	DDD	2013B	240	14	68.933616	740.928571	1303	456	361	43
11	DDD	2014B	241	7	68.365873	648.857143	1228	360	259	49(
12	EEE	2013J	268	5	80.368446	721.000000	1052	482	200	24
13	EEE	2014J	269	5	82.156692	807.250000	1188	527	198	30
14	EEE	2014B	241	5	79.152395	445.000000	694	285	164	17
15	FFF	2013J	268	13	77.145696	1353.333333	2283	908	513	67
16	FFF	2014J	269	13	78.616411	1348.666667	2365	859	393	85
17	FFF	2013B	240	13	77.893981	1016.250000	1614	664	421	41
18	FFF	2014B	241	13	76.530973	849.666667	1500	547	384	46

19	GGG	2013J	261	10	80.820468	661.111111	952	451	294	6(
20	GGG	2014J	269	10	79.576186	485.888889	749	317	179	12(
21	GGG	2014B	241	10	80.007677	544.000000	833	350	255	10(

NOTE- Explaination schema:

- **num_of_assessment** - the number of assessments in the presentation
- **avg_score** - average score per student in specific course and presentation
- **students_take_exam** - the number of average students taking exam in specific course and presentation
- **num_of_student** - the number of students in specific course and presentation
- **Pass** - the number of students passing in specific course and presentation
- **Fail** - the number of students failing in specific course and presentation
- **Withdrawn** - the number of students withdrawning in specific course and presentation
- **Distinction** - the number of distinction students in specific course and presentation
- **num_of_soon_regis** - the number of students registering course soon in specific course and presentation
- **num_of_unregis** - the number of students unregistraion course in specific course and presentation

Note: After clearing table some data is missing (for example: data about assessment exam)

2.2 Processing data about student

- Input tables:
  - student Assessment
  - assessment
  - student information
  - studentVle
  - student registration
- Method: using pandas api **groupby**, **merge** to group and create new table, value and **rename** some columns.
- Output table:
  - Student detailed information (df_studentInfo_score):
    - Table size: (32593, 17)
    - Table columns: ['code_module', 'code_presentation', 'id_student', 'gender', 'region', 'highest_education', 'imd_band', 'age_band', 'num_of_prev_attempts', 'studied_credits', 'disability', 'final_result', 'avg_score', 'num_of_assess_take', 'sum_click', 'soon_regis', 'un_regis']
    - Checking duplicated values:
      - The number of values that student take more than 1 course: 3808
      - The number of values that student take more than 1 course in the same semester: 1081
      - The number of values that student take a course more than 1 time: 1309

	code_module	code_presentation	id_student	gender	region	highest_education	imd_band	age_band	num_of_prev_attempts	studied_credits	disabil
0	AAA	2013J	11391	M	East Anglian Region	HE Qualification	90-100%	55<=	0	240	
1	AAA	2013J	28400	F	Scotland	HE Qualification	20-30%	35-55	0	60	
2	AAA	2013J	30268	F	North Western Region	A Level or Equivalent	30-40%	35-55	0	60	
3	AAA	2013J	31604	F	South East Region	A Level or Equivalent	50-60%	35-55	0	60	
4	AAA	2013J	32885	F	West Midlands Region	Lower Than A Level	50-60%	0-35	0	60	
...	...	...	...	...	...	...	...	...	...	...	
32588	GGG	2014J	2640965	F	Wales	Lower Than A Level	10-20	0-35	0	30	
32589	GGG	2014J	2645731	F	East Anglian Region	Lower Than A Level	40-50%	35-55	0	30	
32590	GGG	2014J	2648187	F	South Region	A Level or Equivalent	20-30%	0-35	0	30	
32591	GGG	2014J	2679821	F	South East Region	Lower Than A Level	90-100%	35-55	0	30	
32592	GGG	2014J	2684003	F	Yorkshire Region	HE Qualification	50-60%	35-55	0	30	

32593 rows × 17 columns

Table 2: Student detailed information

NOTE- Explaination schema:

- **num_of_assess_take** - the number of times that student take assessment
- **sum_click** - the number of clicks that student interact with material of VLE
- **soon_regis** - the student register a course soon compared to the start date of course or not
- **un_regis** - the student unregis a course

2.3 Processing data about material and assessment type

2.3.1 Material

- Input tables:
  - studentVle
  - vle
- Method: using pandas api **groupby**, **merge** to group and create new table, value and **drop** to remove nan values.
- Output table:
  - Material (df_material_click):
    - Table size: (232,1)
    - Table columns: ['sum_click'], index -['code_module','code_presentation','activity_type']
    - Checking duplicated values: None

			sum_click
code_module	**code_presentation**	**activity_type**	
AAA	**2013J**	**dataplus**	1843.0
		forumng	175513.0
		glossary	327.0
		homepage	140345.0
		oucollaborate	241.0
...	**...**	**...**	...
GGG	**2014J**	**homepage**	83253.0
		oucontent	156045.0
		quiz	57337.0
		resource	26147.0
		subpage	17488.0

232 rows × 1 columns

Table 3: Material

2.3.2 Assessment type

- Input tables:
  - studentVle
  - vle
- Method: using pandas api **groupby**, **merge** to group and create new table, value and **drop** to remove nan values.
- Output table:
  - Assessment_type (df_assessments_type):
    - Table size: (41, 3)
    - Table columns: ['assessment_type','avg_score','students_take_exam'], index -['code_module','code_presentation']
    - Checking duplicated values: None

		assessment_type	avg_score	students_take_exam
code_module	**code_presentation**			
AAA	**2013J**	TMA	69.448600	326.600000
	2014J	TMA	68.631236	303.200000
BBB	**2013B**	CMA	87.978861	1009.800000
	2013B	TMA	71.759665	1034.500000
	2013J	CMA	87.788918	1283.200000
	2013J	TMA	71.643283	1326.500000
	2014B	CMA	87.270401	898.600000
	2014B	TMA	71.947250	916.666667
	2014J	TMA	66.123764	1481.600000
CCC	**2014B**	CMA	70.471546	980.000000

Table 4: Assessment Type

Note: Data about exams is missing

Conclusion

- Directions in analyzing after grouping into 4 table:
  - Courses data:
    - Taking the whole detailed picture throughtout platform, courses, and presentation semester. => Comparing figure and making conclusion about course that attract most student
  - Student data:
    - Summarizing in specific features (gender, age_band,..) => Analyzing target students
    - Summarizing withdrawn student => Understanding the reason
  - Material and Assessment type:
    - Compare figure => Evaluating frequency that student go the site and average score and the number of student take each exam

3. Summarizing, Visualizing and Making insights of data

3.1 Courses data

- ***Summary data in virtual learning platforms:***

Summary 3.1.1: total students in VLE according to features

	Total
num_of_assessment	206
students_take_exam	19354
num_of_student	32593
Pass	12361
Fail	7052
Withdrawn	10156
Distinction	3024
num_of_soon_regis	32312
num_of_unregis	10072

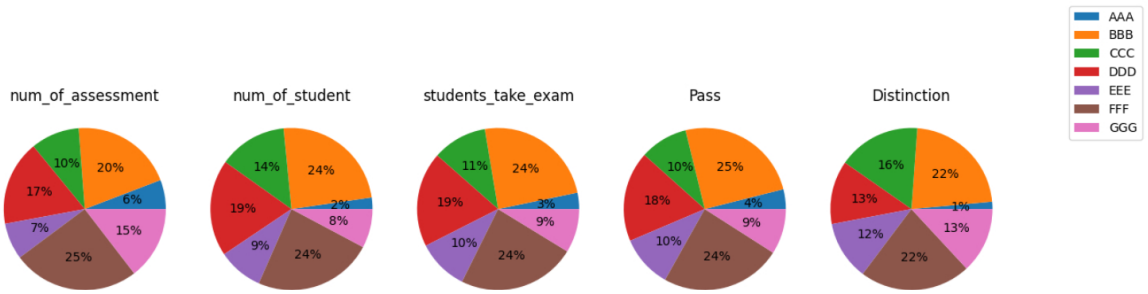
```
Note:
    - num_of_student - The number of students taking course (regard with duplicated values)
```

- ***Summary data per courses:***

Summary 3.1.2: Total students of each course according to features

code_module	AAA	BBB	CCC	DDD	EEE	FFF	GGG
num_of_assessment	12	42	20	35	15	52	30
num_of_student	748	7909	4434	6272	2934	7762	2534
students_take_exam	629	4720	2104	3668	1973	4567	1691
Pass	487	3077	1180	2227	1294	2978	1118
Distinction	44	677	498	383	356	670	396
Fail	91	1767	781	1412	562	1711	728
Withdrawn	126	2388	1975	2250	722	2403	292
avg_score	69	75	73	69	80	77	80
num_of_soon_regis	740	7804	4409	6228	2921	7723	2487
num_of_unregis	126	2377	1947	2235	718	2380	289

Note: + **'Bisque color'** : min value / **'Light green color'** : max value



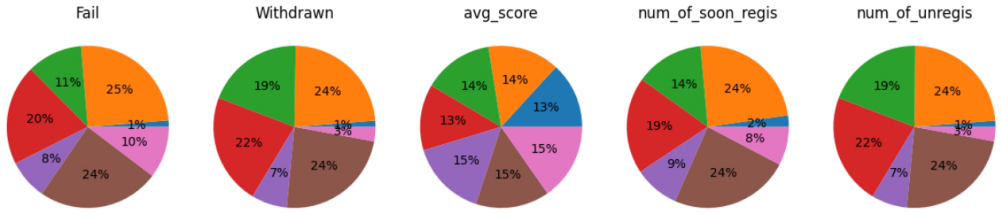


Figure 3.1.1: Display the persentage of students each course according to features

- ***Summary data in per course and each presentation***

Table 3.1.2: Courses information top 10 largest courses

	code_module	code_presentation	num_of_student
0	CCC	2014J	2498
1	FFF	2014J	2365
2	BBB	2014J	2292
3	FFF	2013J	2283
4	BBB	2013J	2237
5	DDD	2013J	1938
6	CCC	2014B	1936
7	DDD	2014J	1803
8	BBB	2013B	1767
9	FFF	2013B	1614

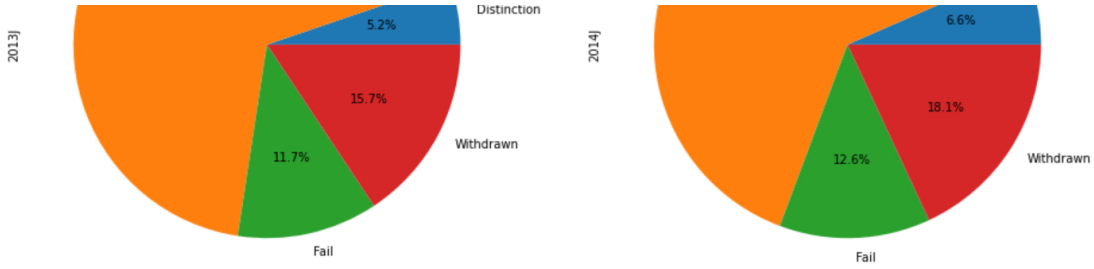


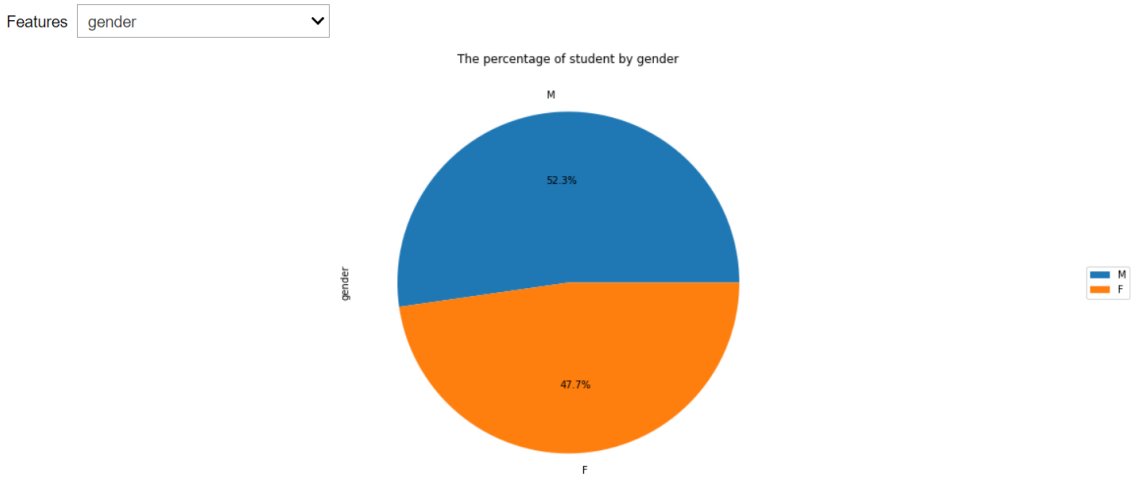
Figure 3.1.2: The number of student in vle of each presentation semester and Figure 3.1.3: The percentage of students in the final result

3.2 Student data

Table 3.2: Student detailed information (the first 10 rows)

	code_module	code_presentation	id_student	gender	region	highest_education	imd_band	age_band	num_of_prev_attempts	studied_credits	disability
0	AAA	2013J	11391	M	East Anglian Region	HE Qualification	90-100%	55<=	0	240	N
1	AAA	2013J	28400	F	Scotland	HE Qualification	20-30%	35-55	0	60	N
2	AAA	2013J	30268	F	North Western Region	A Level or Equivalent	30-40%	35-55	0	60	Y
3	AAA	2013J	31604	F	South East Region	A Level or Equivalent	50-60%	35-55	0	60	N
4	AAA	2013J	32885	F	West Midlands Region	Lower Than A Level	50-60%	0-35	0	60	N
5	AAA	2013J	38053	M	Wales	A Level or Equivalent	80-90%	35-55	0	60	N
6	AAA	2013J	45462	M	Scotland	HE Qualification	30-40%	0-35	0	60	N
7	AAA	2013J	45642	F	North Western Region	A Level or Equivalent	90-100%	0-35	0	120	N
8	AAA	2013J	52130	F	East Anglian Region	A Level or Equivalent	70-80%	0-35	0	90	N
9	AAA	2013J	53025	M	North Region	Post Graduate Qualification	nan	55<=	0	60	N

- **Number of students that participate in the virtual learning platform** : 28785



	M	F
gender	15046	13739

Figure 3.2 the percentage of students and the number of students that are categorized according to features

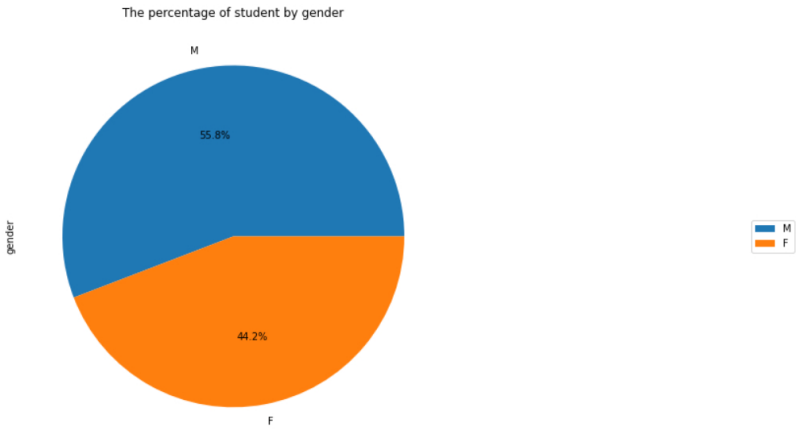
3.2.1 Data of withdrawn students

Table 3.2.1: Top first 10 withdrawn students that have high score

	code_module	code_presentation	id_student	gender	region	highest_education	imd_band	age_band	num_of_prev_attempts	studied_credits	disabil
9523	CCC	2014B	575419	M	West Midlands Region	Lower Than A Level	50-60%	0-35	0	90	
26262	FFF	2014B	163962	M	Yorkshire Region	A Level or Equivalent	60-70%	0-35	3	120	
11370	CCC	2014J	566664	M	London Region	A Level or Equivalent	40-50%	0-35	1	60	
7690	BBB	2014J	656122	F	Ireland	Lower Than A Level	30-40%	35-55	0	60	
11300	CCC	2014J	554444	F	West Midlands Region	Lower Than A Level	10-20	0-35	0	60	
11201	CCC	2014J	529723	M	South West Region	A Level or Equivalent	40-50%	0-35	0	90	
12359	CCC	2014J	652994	M	North Western Region	Lower Than A Level	10-20	0-35	0	120	
10992	CCC	2014J	469614	M	Wales	Lower Than A Level	10-20	0-35	1	90	
10980	CCC	2014J	465764	F	East Midlands Region	Lower Than A Level	30-40%	35-55	1	60	
10635	CCC	2014J	96864	M	West Midlands Region	HE Qualification	20-30%	0-35	0	30	

- **The number of withdrawn student that take a course more than 1 time**: 497
- **The number of withdrawn student that take more than 1 course in the same semester**: 365

Features gender



	M	F
gender	5670	4486

Figure 3.2 the percentage of withdrawn students and the number of withdrawn students that are categorized according to features

3.3 Data about material and assessment type

3.3.1 Material

Choose
- AAA
- BBB
- CCC
- DDD
- EEE
- FFF
- GGG

The material in 2013J presentation

activity_type	sum_click
dataplus	1843
forumng	175513
glossary	327
homepage	140345
oucollaborate	241
oucontent	267482
resource	7365
subpage	39624
url	15754

The material in 2014J presentation

activity_type	sum_click
dataplus	1555
forumng	161590
glossary	329
homepage	126375
oucollaborate	257
oucontent	255912
resource	7559
subpage	31958
url	12623

Table 3.3.1 The material of each presentation semester 2013,2014

3.3.2 Assessment type:

Choose
- AAA
- BBB
- CCC
- DDD
- EEE
- FFF
- GGG

code_presentation	assessment_type	avg_score	students_take_exam
2013B	CMA	79.482843	954
2013B	TMA	75.669574	1102
2013J	CMA	79.671752	1263
2013J	TMA	73.609217	1478
2014B	CMA	78.287922	792
2014B	TMA	74.071244	929
2014J	CMA	80.366680	1273
2014J	TMA	76.166034	1453

Table 3.2.2 The assessment types and average score, the number of students in a specific course

4 Conclusion:

After analyzing data, it's clearly to see that almost all courses had the figure that decreased throughout 2013, 2014. Besides that, the number of withdrawn students was high.

- In the table 3.1.1, we can see that:
  - Course **'AAA'** had min values at all features
  - Course **'BBB'** had max values at almost features
  - Courses **'EEE'** and **'GGG'** had a higher average score than others
  - Course **'FFF'** had the largest number of student that unregister from course
- In the figure 3.1.1: => Course **'BBB'** accounted for the highest percentage in almost fature.
- In the figure 3.1.2:
  - The number of student almost descreased in each presentation semester.
- In the 3.2 at the feature final_result:
  - The percentage of withdrawn students accounted for the second high quarter of the final result.

Weakness

- It's hard for me to make the conclusion, I know, it's a bad weak point for data analysts. I think that I don't have enough experience to make a perfect conclusion. And I would try hard every day to improve it.
- Unfinished task:
  - Make the perfect conclusion
  - Grouping withdrawn students in some new features base on the number of clicks, the number of assessment that students take => Categorizing group of students and giving the reason why those students wanted to withdraw
    - Methode use: dividing sum_click, num_of_assess_take into 5 ranges and categorizing base on this range, and then visualizing pie charts to see the percentage of students in each range.
    - Modifying and detailing all charts.
- My file is quite hard to run, and if I convert it into pdf or HTML file, the interactive figures are closed. Please, I have 2 images of the whole dashboard that are converted into pdf in order to visualize (they are not complete).

NOTE:

- Python version 3.8
- If you want to interactive with the notebook, Please:
  - install some required libraries by running below commands:
    - pip install pandas
    - pip install matplotlib
    - pip install jupyter notebook
  - Open in the jupyter notebook:
    - In command line promps:
      - cd [Directory of file here]
      - jupyter notebook
      - localhost:8080 is opened
      - click that file 'Report_Analysis_VLE_data.ipynb'
      - click cell and selected run all
    - To visualize dashboard in pdf:
      - PDF image 1: Report_analysis_VLE_data_PDF_image_1.pdf
  - Open with voila:
    - In command line promps:
      - pip install voila
      - Run voila [Directory]/Report_Analysis_VLE_data.ipynb
      - localhost:8866 is opened
    - To visualize dashboard in pdf:
      - PDF image 2: Report_analysis_VLE_data_PDF_image_2.pdf