3D Class: A gamified learning environment.

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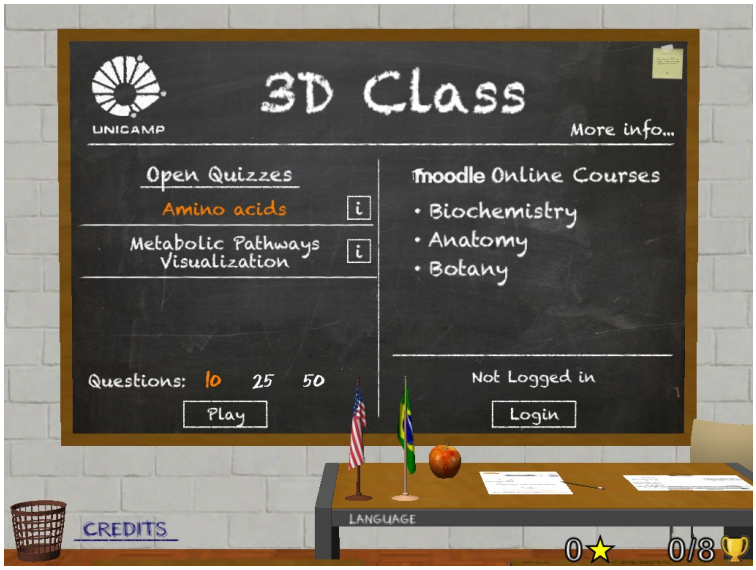

Figure 1: 3D Class main screen

Abstract

This paper describes a gamified teaching and learning application for tablets: the 3D Class. The 3D Class acts as an interface between Moodle and Apple's Game Center, bringing users to play games while learning, and to learn while gaming. For the students enrolled in courses that are available in a Moodle server, the 3D Class can be used to access them from iOS enabled devices. The integration with the Game Center allows users to compete among other apps users. Even for the users that are not enrolled in any course, they can play the open quizzes, and score in the Gaming Center.

Keywords: Course Management System (CMS), Learning Management System (LMS), Moodle, iOS, Game Center, Learning Teaching Environment, Apps.

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1. Introduction

This paper describes a gamified teaching and learning environment for tablets, the 3D Class. More and more learners opt to access web sites within their courses using mobile devices rather than traditional notebooks or desktop computers [Daniels 2012; Kolowich 2011]. The most popular Learning Management Systems (LMS) such as Blackboard and Moodle have already released apps for tablets and smart-phones that give access to some of the content available on those LMSs.

Moodle is the second more used LMS and the first among the open source ones; it has more than 66 thousand of registered sites in 215 countries - which sum up more than 6 million courses - more than 58 million users, and more than 112 million quiz questions. Brazil is the third country in Moodle registrations. It has been used for many public and private Brazilian education institutions, including the Brazilian Open University. Moodle is also the top grossing LMS; it's grown 10% market share while Blackboard usage has dropped 6% in 2010 [ICT 2011].

Moodle offers a lot of functionalities, although, to be used with the 3D Class, some adjustments will have to be made on the server side. For any course made available to the 3D Class, the topics will be listed, and the user will have access not only to the pages which are used in 3D Class to deliver slides, videos and audio contents, but also to quizzes and forums.

A gamification process was applied to make 3D Class more interesting, fun and challenging. Gamification can be defined as the use of elements of game design for non-game application [Raymer 2011; Deterding et al. 2011], it can be applied to a wide range of contexts, and is already been used in eLearning.

Apple's Game Center here was used as the competition element of the gamification. The Game Center is a service that allows users to compare their

scores with other players on what is called a leaderboard. It allows users to be awarded with the so-called “achievements”, which are defined by each game, and are intended as incentives to keep people playing. The Game Center also provides a mechanism for multiplayer games [Jordan 2011].

2. Related Work

There are a number of mobile applications available for iOS and Android devices that support mobile users accessing Moodle, such as My Moodle, Umm and MLE-Moodle [Daniels 2012], and also to make Moodle accessible by web based interface from the mobile devices little screens [Forment and Guerrero 2008]. There is also an example of gamification in Moodle based eLearning system, the Sloodle [Livingstone et al. 2008].

3. The 3D Class

The 3D Class reproduces a school environment, bringing the user to a more realistic experience in a virtual environment. The App’s main screen reproduces a room with a blackboard and a desk. From this room the users may take an open quiz, or login to gain access to the other rooms. For each course assigned by the users they will gain access to a specific room (Figure 2).

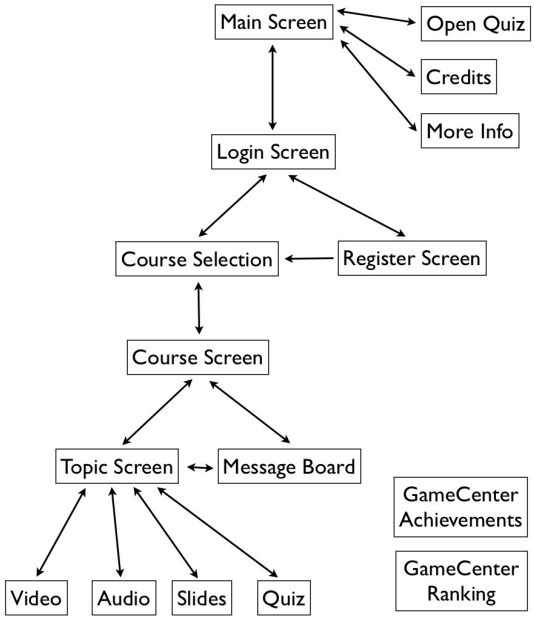


Figure 2: 3D Class App functionalities overview

The 3D Class has two major components: the App itself and the server side scripts. The server side scripts act as a bridge between App and Moodle, and also between App and Game Center. The 3D Class is set to connect to the Educational Technology Lab Moodle Server by default; the option to connect to other servers will be provided further on.

The only scripting needed to the Moodle server is the one that gives the course designers the option to decide if a course will be available for the 3D Class or not. The “Edit course settings” gained an option to check if the course will be “Available for 3D Class” or "Not available for 3D Class". The courses made available for the 3D Class may also be available as any Moodle course. There is another option box to set if the course will be available on the web, as a regular Moodle course, or not.

Once connected to the server, the 3D Class App loads the “Open Quizzes” and the “Online Courses” contents. The Open Quizzes can be played by any App users, but to access the Online Courses, the user must be registered and meet the course enrollment requirements.

3.1 The 3D Class server

To enable a Moodle server to deliver content to the 3D Class App, it must be enabled on the 3D Class server.

Any course available in a Moodle sever may be available for the 3D Class. On the other hand, only the content readable by the 3D Class Application will appear in the user's tablet. The course designer will have to take the 3D Class structure into account while planning a course, and decide whether the course will be 100% compatible with the 3D Class or if the learners will have to be connected using Moodle’s regular access to have some of the tasks done.

The Moodle resources readable in the 3D Class, so far, are the following: forums, quizzes and pages. The pages should be used to deliver slide presentations, videos and audio contents. Each course may have pages and quizzes as many as needed, but for each topic only one quiz, and only up to three pages will be read (one with slide presentation, one with video, and one with audio content).

The quizzes available in a course will not be available in an open quiz 3D Class section, but the Moodle’s questions statistics will be used to feed the 3D Class questions report page. Depending on how a quiz is set, it will behave exactly the same on both Moodle and 3D Class.

On the server side, PHP scripts are responsible for the communication between the App and the Moodle database. The App sends messages to the server and those scripts can return Moodle’s database data such as: available courses, forum posts, quizzes and course content. It can also check the login, and insert information in the Moodle database, which can be seen by the instructors on the Moodle website.

The server is also responsible for collecting the open quizzes results from all users connected to the Internet, and it can generate reports to follow the

student's performance and individual question statistics, such as average time to answer, difficulty and percentage of correct answers. This report can be accessed through a URL protected with a password on the 3D Class server side (Figures 3, 4 and 14).

When the user is playing an Open Quiz, the chosen answer is sent to the server in real time. If the user is not connected to the Internet at that moment, the App stores all the results locally and the next time the user opens the App with an Internet connection, the App automatically sends the stored results.

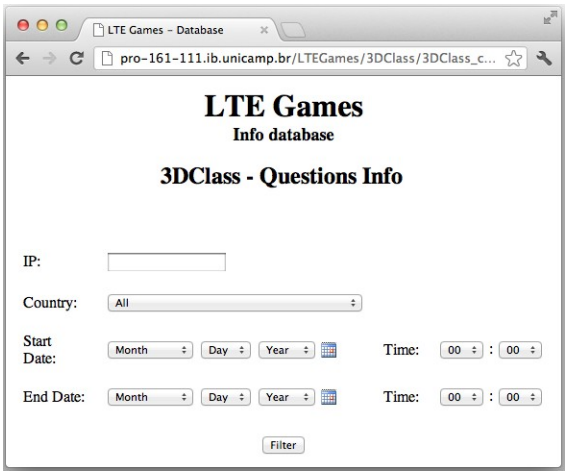
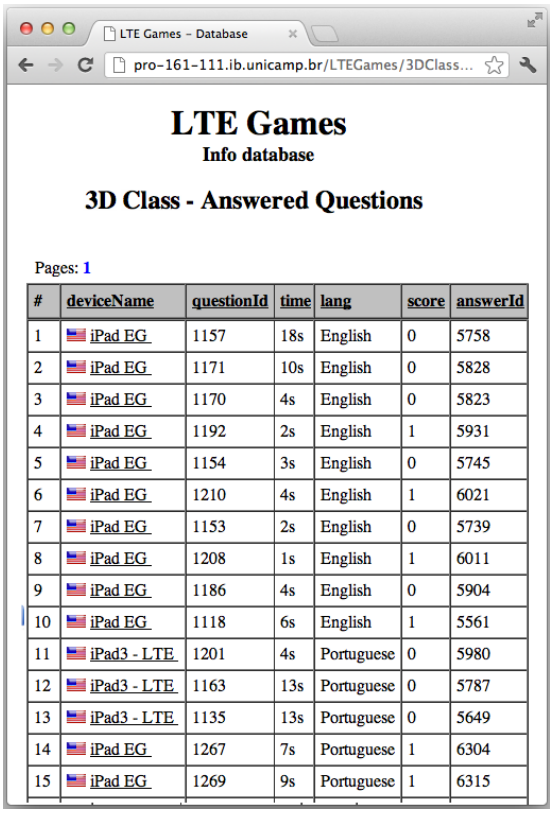


Figure 3: Answers results filter settings on the server side



#	deviceName	questionId	time	lang	score	answerId
1	iPad EG	1157	18s	English	0	5758
2	iPad EG	1171	10s	English	0	5828
3	iPad EG	1170	4s	English	0	5823
4	iPad EG	1192	2s	English	1	5931
5	iPad EG	1154	3s	English	0	5745
6	iPad EG	1210	4s	English	1	6021
7	iPad EG	1153	2s	English	0	5739
8	iPad EG	1208	1s	English	1	6011
9	iPad EG	1186	4s	English	0	5904
10	iPad EG	1118	6s	English	1	5561
11	iPad3 - LTE	1201	4s	Portuguese	0	5980
12	iPad3 - LTE	1163	13s	Portuguese	0	5787
13	iPad3 - LTE	1135	13s	Portuguese	0	5649
14	iPad EG	1267	7s	Portuguese	1	6304
15	iPad EG	1269	9s	Portuguese	1	6315

Figure 4: Each question result from an open quiz

3.2 The 3D Class App

The screens are designed in such a way that the elements of the scenario behave like buttons and the screen transitions are made by the movement of the camera, focusing on one element of the scenario that represents a new screen.

Objects in the scenario represent some Moodle contents, for example, the available courses are represented by school elements such as:

- Classroom doors with the course name and the professor's name give access to the courses (Figure 5);
- The forum is represented by a message board on the wall (Figure 6);
- A course description and topics list can be seen on the blackboard (Figure 7);
- Book and papers that give access to the topic's slides and homework can be found on the student's desk (Figure 8);
- In the student's desk, an MP3 player that gives access to the audio content, and a tablet that gives access to the video content (Figure 8) can be also found.

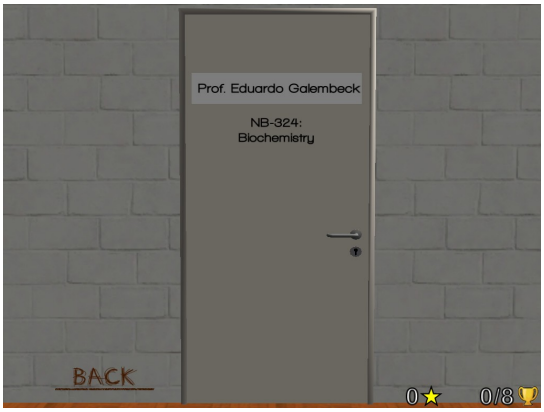


Figure 5: The scenarios object the gives users access to the courses

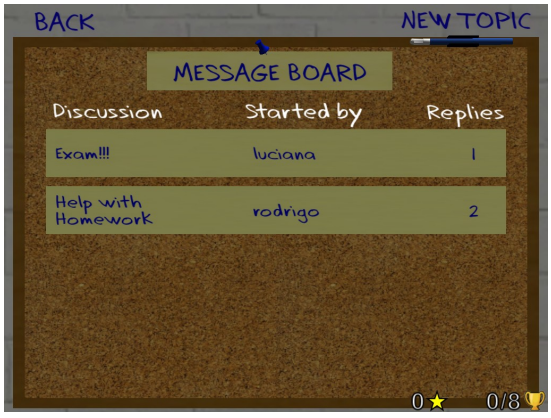


Figure 6: The message board shown in the room wall that gives access to the forums

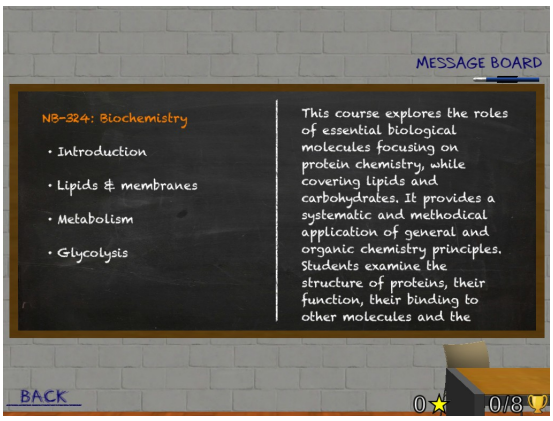


Figure 7: A course main screen

Figure 8: A course topic screen, that gives access to the lessons (in audio and video), and to the homework (Quiz)

3.3 Open Quizzes

The Open Quizzes section is the most challenging part of the game. The connection between the Open Quizzes and the Apple's Game Center ranks all players, and can be used to invite friends to play.

The Open Quizzes section is set as a hidden course in a Moodle server, each quiz is a topic that is associated to some Moodle's question bank category.

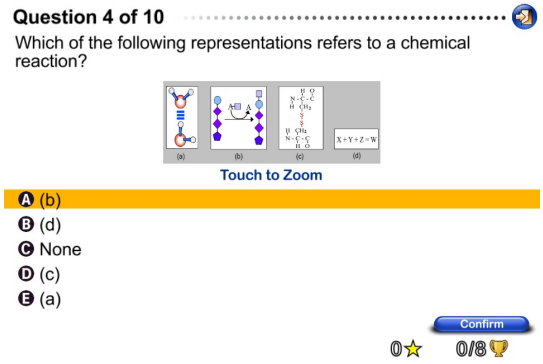


Figure 9: An example of a quiz question

The Open Quizzes are set in the Moodle server using the questions bank. To set an Open Quiz, the quiz designer should group the selected questions. The group of questions has to be named according to the desired name to be shown in the 3D Class App Open Quizzes list.

The Open Quizzes may be set not only to test users knowledge in a given topic or as a part of a summative assessment, but they can also be set to give support to the Moodle's questions feedback, and used in a formative assessment approach. Thinking about a single user, who downloaded the App and is playing the Open Quizzes, if his questions did not give feedback about the choices he's making, they will be more useful for testing the user's knowledge. On the other hand, if the questions give a feedback after the user's answering, they will better improve student's learning, because if the wrong answer is picked, a brief explanation about why that answer is not correct will be provided.

3.4 Courses

Technically any course available in a Moodle server can be made available in 3D Class, but as only the functionalities compliant with the 3D Class will be fully usable by the App, we recommend special attention to the course development do make it available in the 3D Class.

The typical course set through Moodle to be compliant with the 3D Class should be based in the content delivery (Slides, video and audio files), forums discussion, and assessment (Quiz) approach.

To deliver content trough the 3D Class, the course instructors have three options available: slides (images), audio files, and video files. Any combination of this media can be used in each course topic.

The forum provides a way of interaction among the people involved in each course. The 3D Class forum is integrated to the Moodle's forum, but with some limitation that will require the instructor to connect to the course through the Moodle server to perform some forum management actions.

The assessment tool is provided by quizzes. Apart from the 3D Class Open Quizzes, the course quizzes are integrated to the Moodle quizzes. The quizzes statistics will be counted together, and like the other tools available for the user in the 3D Class, they will also be accessible through the Moodle server.

Some actions taken in the courses section, even being available only for the users enrolled in courses, are also scored in the Game Center.

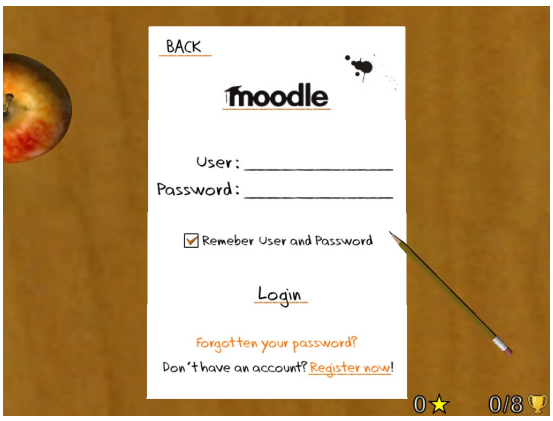


Figure 10: Login/Registration screen to gain access to the courses available in the Moodle server

3.5 The 3D Class Gamification

To gamify our learning environment, we used the 6-11 framework game design approach, proposed by Dillon R. [2011]. Specifically, the framework focuses on six emotions (Fear, Anger, Joy, Pride, Sadness, Excitement) and eleven instincts (Survival, Self Identification, Collecting, Greed, Protection, Aggressiveness, Revenge, Competition, Communication, Curiosity, Color Appreciation) that are recurrent in psychology and widely analyzed in a number of well known treatises.

The main idea behind the 6-11 Framework is that these emotions and instincts interact with each other to build a network or sequence that should end with "Joy" and/or "Excitement", so as to provide players with a meaningful and fun experience.

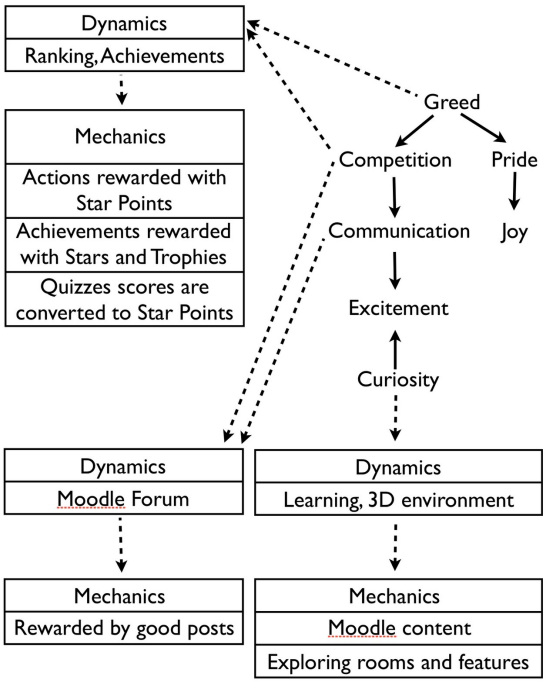


Figure 11: 6-11 Framework scheme for 3D Class

In the 3D Class App, we use 3 emotions (Pride, Joy, Excitement) and 4 instincts (Greed, Competition, Communication, Curiosity). Users are encouraged to compete earning Star Points, through their actions inside the App. They can earn the stars by answering quizzes, reading, watching and listening to the class material, writing good posts on the forum (the Moodle instructor can rate each post), and achieving some goals.

Players can track their Star Points and Trophies in the right bottom corner of the screen. It is fully integrated with Apple's Game Center.

Tapping the star icon will lead the player to the Game Center Leaderboard. They can see the ranking and compete with who has more stars.

Figure 12: Game Center Leaderboard

Tapping the trophy icon will lead the player to the Game Center Achievements. They can see the goals to accomplish to win a trophy. Currently, 3D Class has 8 achievements, but more can be added later on App updates.

The 3D Class current achievements:

1. The Observer: The player must observe the credits screen for 2 minutes.
2. The Polyglot: The player must score at least 80.00 in any quiz in all languages available.
3. Thinking Hat: The player must score more than 80.00 in a 50 question open quiz.
4. Quiz Lover: The player must answer all quizzes available.
5. The Starter: The player must start a discussion in the Message Board with more than 20 replied posts from other users.

6. The Regretter: The player must post something on a started discussion on the Message Board and delete it.
7. Intense Week: The player must log in 7 consecutive days.
8. Smart Brain: The player must score 100.00 in 5 different quizzes.

Figure 13: The 3D Class Achievements

The use of Game Center Leaderboard and Achievements, also give to the teachers the possibility to run activities with their classes, and get their student to compete with each other.

3.6 The multi language support

The 3D Class has a multi language support. It is already set to be used in Portuguese and English. The flags presented in the desk shown in figure 1 can be used to set the language.

To be fully multilingual, some actions should be taken on the Moodle side, while setting a course or a quiz. Moodle's multi-language filter must be turned on, and the following tags must be used to every text block entered on Moodle:

```
<span lang="en" class="multilang">
text_in_English </span>

<span lang="pt_br" class="multilang">
text_in_Portuguese </span>
```

The multi language support opens opportunities not only to deliver courses to students worldwide, but it also makes possible to compare the Open Quizzes outcomes from users worldwide.

4. Future works

The App is on its final stage of development and soon will be published in the Apple's App Store and tested with both students and random users to verify if the App is efficient both for learning and fun.

We are planning to release an update to allow the students to change the Moodle server address. So they can connect to their college Moodle server.

We are also planning to release the 3D Class – Teacher Edition. On this App, the teacher will be able to add content and track their students' progress.

5. Conclusion

The gamification of a Virtual Learning Environment brings the users to a unique experience with an extra input to motivate learning. The 3D Class can be used both as a game based learning environment and as a formal VLE, with a beautiful and easy to use 3D interface.

Acknowledgements

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questionId	answered n times	alternative 1		alternative 2		alternative 3		alternative 4		alternative 5	
		answer	%	answer	%	answer	%	answer	%	answer	%
1247	5	(a)	40%	(b)	60%	(c)	0%	(d)	0%	None	0%
1261	5	(a)	0%	(b)	80%	(c)	20%	(d)	20%	None	0%
1262	5	2, 3, and 6	0%	1, 4, 5, and 7	20%	2, 3, 5, and 6	40%	All of the other alternatives are incorrectÂ	20%		0%
1263	5	R and K are products in chemical reactions, I, II, and III	20%	R is subtrate and productÂ in chemical reactions I, II, and III	0%	X and W are subtrates in chemical reactions I, II, and III	20%	X and W are products in chemical reactions I, II, and III	40%	All the other alternatives are incorrect	20%
1264	7	Y is substrate, and product of reactions 1 and 2	14.29%	W is the substrate of reaction 3	42.86%	Z is substrate and product of reaction 3	0%	N is product of reaction 1	14.29%	All the alternatives are incorrect	28.57%
1265	5	Phosphorylation occurred in reactions 1 and 2	20%	Reduction-oxidation occurred in reactions 1 and 3	60%	Isomerization occurred in reaction 3	0%	Phosphorylation occurred only in the reaction 2	20%	All coices are incorrect	0%
1266	4	All choices are correct	0%	In reaction (d), NAD^+ is the electrons donnor, and passes electrons to H_2O, forming a reduced coumpound, the $NADH + H^+$. The H_2O is reduced to O_2	0%	In reaction (c) the CO_2 is incorporated to the substrate to form the product	25%	In reaction (a) the substrate is broken down, and H^+ e OH^- are incorporated to the products formed	25%	In reaction (b) the addition of H_2O caused the substrate brake down	50%
1267	4	To start: only A To keep: A and NAD^+	0%	To start: A, B, C, D, E To keep: A, B, C, D, E, F	0%	To start: A, NAD^+, $NADH + H^+$ To keep: A, NAD^+, $NADH + H^+$	25%	To start: A and NAD^+ To keep: only A	50%	None of the option are correct	25%
1268	2	9	0%	10	0%	1	100%	0	0%	None of the options	0%
1269	7	All alternatives are incorrect	0%	K, NAD^+, FMN, Fe^{3+}, CoQ, Y	14.29%	Y, CoQ,Â Fe^{3+}, FMN,Â NAD^+, K	28.57%	YH_2, CoQ, Fe^{2+}, FMN, NADH + H^+, K	14.29%	YH_2, $CoQH_2$,Â Fe^{2+}, $FMNH_2$,Â NADH + H^+, KH_2	42.86%
1270	6	9C	16.67%	18C	33.33%	21C	16.67%	36C	0%	None of the alternatives	33.33%
1271	5	In reaction 3, the absence of H-R releases the subunits Y-Z from the GDP-X-Y-Z complex	0%	In reaction 2 the presence of H-R keep X-Y-Z attached to GDP	0%	In the reaction 4, GTP-X binds to the enzyme, and activates it. The active enzyme catalyzes the reaction 5 forming K from W	40%	The GTP-X is an enzyme and catalyses the reaction 4	60%	All alternatives are incorrect	0%
1272	5	(F)	80%	(X)	0%	(V)	0%	(Q)	20%	None of the options	0%

Figure 14: Open Quiz questions report