Using Kahoot! to enhance the learning experience in Chemistry 176
Faculty of Science | Department of Chemistry and Polymer Science

1

Module: Chemistry 176
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Learning activity:
The enhancement of student engagement in contact sessions using a gamified activity

Learning technology:
Kahoot!

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Context
Background overview and topic
Chemistry 176 is an introductory Chemistry module offered by the Department of Chemistry and Polymer Science to first-year students in the BSc Extended Degree Programme. On average, approximately 150 students who do not meet the minimum admission requirements for their chosen programmes in either the Science or Engineering faculties enrol for the course each year. The students are divided into three lecture groups with two groups receiving instruction in English and the third group receiving instruction in Afrikaans.

The Chemistry 176 curriculum focuses on establishing a basic knowledge of fundamental chemical principles, including general atomic theory, acid-base theory and chemical equilibrium.

The timetable consists of three lectures and a three-hour tutorial/practical session each week. Formative assessment activities in the module include spot tests in class, tutorial tests and practical reports.

The challenge
The only way in which the lecturer or students could gain feedback on the students' understanding of new content during formal contact sessions with students was through spot tests and tutorial tests. Two negative aspects of using these types of formative assessments are that (1) students feel pressured into "performing for marks" and (2) students receive delayed feedback on their understanding, as the lecturer first needs to grade their assessments.

Advantages associated with the integration of technology
Various technological resources provide the means to offer immediate feedback to students on their performance. They also create a bridge between the traditional setting of the classroom and the ever-increasing digital and technological world in which students are immersed (Oomen-Early & Early, 2015). Furthermore, game-based learning and gamification of learning have proved to be effective tools to enhance student engagement. This, in turn, can support the development of problem solving and critical thinking skills. Games have also been used to review class content effectively (Dellos, 2015).

**Figure 1: Learning technologies can provide immediate feedback to students

Learning and assessment activities
Educational approach
The digital gamified platform Kahoot! (https://getkahoot.com) was identified as one such technological resource that could assist in providing students with immediate feedback. Additionally, it would introduce a game element to the formal contact sessions in Chemistry 176. The aim was thus to enable students to evaluate their own understanding of content covered during class time in a more gamified environment as an alternative to the traditional spot tests and tutorial tests.

Learning activities
Kahoot! is a web-based application that is used to create multiple-choice quizzes or surveys in a game-like environment. Students can complete these activities using their mobile devices, including cell phones, tablets or PCs, as clickers to choose suitable answers. In contrast to traditional clickers, no financial input, such as buying clickers or associated software, is required. Kahoot! is available to the public for free and currently boasts user numbers of over 50 million, with the target group being the education

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2

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sector (Wired UK, 2015).

Kahoot! aims to create a safe learning environment in which a quiz creator (the lecturer) introduces a new topic and then uses a quiz to engage students in critical thinking. Through actively participating in the quiz, students assess their own understanding of a topic and receive immediate, personalised feedback.

In a typical Kahoot! quiz, questions are created by the quiz creator with up to four possible answers. A time limit ranging between 10 and 120 seconds per question can also be set. Media, such as images and videos, can be inserted into questions and points are awarded for correct answers whereas an incorrect answer results in a 0 score.
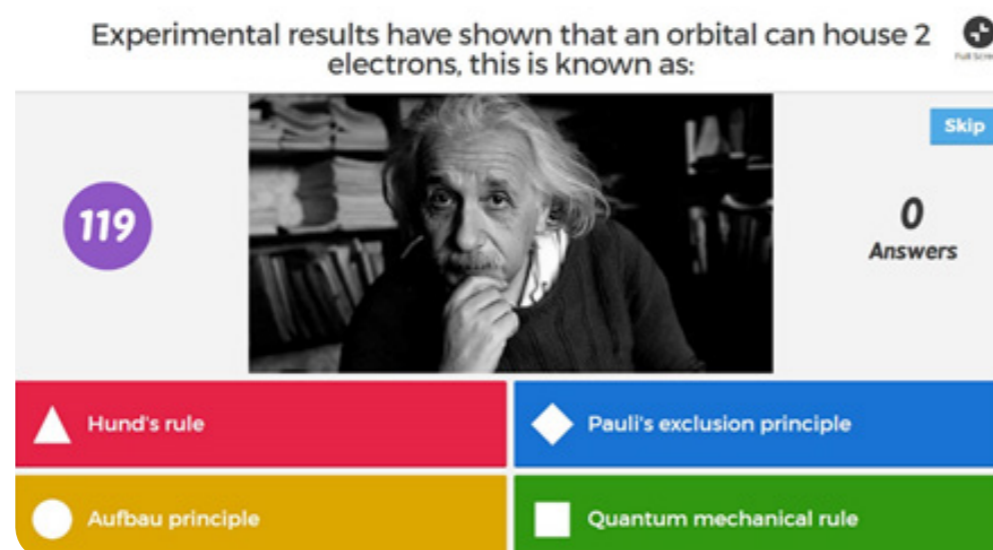

Figure 2: Screenshot of a question in Kahoot!

When a quiz is ready to be played, the quiz creator activates a game pin similar to an access key or password. Students enter this pin on the Kahoot! site to gain access to the specific game. When all students have entered the game pin and have chosen a name for themselves to play the game with, the quiz creator starts the game.

There is also an option for students to replay quizzes in "ghost mode", which allows them to revisit their mistakes in their own time and chosen setting.

Assessment activities

In the Chemistry 176 module, Kahoot! quizzes were initially used to enhance student engagement in class. They also allowed students the opportunity to evaluate their understanding of new concepts without the pressure of a test scenario.

The Kahoot! quizzes were eventually also incorporated into tutorial sessions. During these sessions, students were encouraged to participate in small competing groups, thus creating a peer learning opportunity and exploiting more of the competitive game element that Kahoot! offers. Students had to choose names for their groups, which added to the fun aspect of the activity. Students furthermore proposed questions used to create these quizzes and were thus even further engaged in the learning process. The quiz results were counted as a tutorial test mark in the calculation of the final semester mark for the module.

Feedback practice

After a question is answered, the correct answer is revealed and students are awarded points based on the correctness of their answer and on how quickly they selected their answer. A leader board keeps track of students with the most points after each round and of students "on a streak" when multiple questions are answered correctly. Students who do not perform well during a couple of questions are given a "come-back" message to act as encouragement.

Of critical importance is the data that are collected by Kahoot! Lecturers get access to information about questions answered correctly and to the time taken to answer questions. The data are summarised in Kahoot! in an Excel sheet that can be saved by the quiz creator. This provides valuable feedback to the lecturer as to the level of understanding of students without over-assessing students using formal test activities.

Figure 3: Screenshot of data feedback

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3

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Student self-regulation
Students also receive immediate feedback on the questions that they answer and these answers can then be discussed further in class. This provides students with an opportunity to assess their knowledge on a topic without any of the pressures that are normally associated with formal assessments.

Student experience
Student feedback on the learning experience
Students give feedback at the end of each quiz on how they experienced the activity by answering several questions. This information is reflected anonymously to the quiz creator in an Excel sheet. Below is an example of such a report:

QUESTION	RATING
How fun was it?	5
Did you learn something?	1
Do you recommend it?	1
How do you feel?	
- Positive	0,625
- Neutral	0,25
- Negative	0,125

Figure 4: Screenshot of student feedback

Assessment impact
Students can partake in a learning activity that is not linked to a formal assessment, which relieves some of the pressure to "perform for marks" and creates a fun and engaging environment for learning. Many students now request weekly Kahoot! quizzes in order to test the content covered during the week.

General
Opportunities
The activities offered a more relaxed and engaging environment that was stimulating and goal-driven for the students.

Challenges and advice
Kahoot! works extremely well as a self-assessment tool, although connecting to the quiz uses Internet data, which has cost implications. The cost is minimal but it cannot be assumed or expected that all students can partake in the electronic version. It is thus good to have an alternative strategy, such as combining students into small groups to ensure that everyone can participate in the activity. When playing the game individually, students can also be encouraged to participate by writing down their answers for a question and checking whether the answers are correct. They can then still participate in the discussions afterwards.

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