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The Effect of Review Questions and Response Cards on Increases in Active, Accurate Responses by Spanish University Students

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GQ2 **Abstract**

GQ4 The aims of this study were to compare the use of Review Questions (RQs) and RQs + Response
GQ5 Cards (RCs) in a Spanish university context; to observe which procedure most increases Active Student Responses (ASRs), to verify whether the use of these procedures improves the accuracy of students' exam scores; and, to observe whether unscheduled ASR increases under experimental conditions. 67 Spanish university students from a Spanish public university participated in the study. An A–B design of alternating treatments was used to compare the use of RQ and RQ + RC. The results showed that the condition RQ y RQ + RC increased the frequency of ASRs and RQ + RC improved the accuracy of students' answers in online exams. There was also an upward trend in unscheduled ASRs during both conditions. The conclusion was that more research is needed to improve the daily teaching practice of university teachers by developing strategies to facilitate formative assessment, to improve ASR and, by extension, to improve the effectiveness of students' final exam scores.

Keywords

Response cards, accuracy, active student responses, revision questions, response opportunities, university students

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Introduction

One of the greatest challenges in teaching is to make the student an active agent in the learning process. This task is complicated when the teacher allows the student to spend too much time passively listening to lectures. Despite the advancement of technology and the use of digital technology in university lecture halls (Moodle, email, website, blogs, etc.), more traditional methodologies are often developed, such as a lecture or master class model of presenting information and an evaluation process centered on a final exam. (Roughley et al., 2021; Short & Martin, 2012; Taras, 2002). One of the consequences of this situation is that students are more interested in the result than in the learning process. Research indicates that most university students find it difficult to commit to studying a subject until they are close to the exam date, even though they are reminded not to leave everything to the last minute (Raof et al., 2010 in Short & Martin, 2012; Taras, 2002; Tracey, 2006).

In the teaching–learning process, the teacher plays a relevant role, requiring a renovation and search for strategies to facilitate and improve this process. Teaching innovation, research, and professional practice come together to provide teachers with innovative strategies with scientific evidence, which in the scientific literature is identified as Scholarship of Teaching and Learning (SoTL). SoTl is a strategy that seeks to unify innovation in research and its application in teaching practice, trying to reflect how teaching practice has a relationship with student learning (Barrientos Amador & Aucoin, 2018). Fanghanel et al. (2015 in Roughley et al., 2021) suggests SoTL as a strong paradigm that drives the revision and change of teaching practices by promoting a research approach to practice. In this sense, an innovation in post-compulsory education would be the incorporation into the teaching process of numerous training opportunities together with the use of digital technological resources (platforms such as Moodle, Socrative, e-mail, etc.) already common in this context. Evidence suggests, for example, that formative assessment can have a greater impact than summative (final examination) assessment procedures (Black & William, 2003). Formative assessment could include weekly quiz-like tasks reviewing the content taught in lectures (Miller & Shulka, 2008; Peat & Franklin, 2002). It would also be useful to include review questions during lectures, allowing the lecturer to encourage students to engage with tasks and facilitating immediate feedback which would promote learning (Short & Martin, 2012).

Even today, historical methodologies associated with post-compulsory education focus on the passivity of the student are still observed. University lecturers usually stand in front of the class and present material to students vocally and textually (online), asking questions but usually not checking the students' level of understanding. This approach does not encourage active responses from students, which tend to be infrequent and given only by students with a high academic level (Heward, 2009). Active student responses (ASRs) are defined as observable responses to instructional antecedents (Cavanaugh et al., 1996; Sterling et al., 1997). They are observed when the learner intervenes in class, for example by raising a hand, asking a question, sharing an experience, or answering a teacher's question (Tincani & Twyman, 2016). It has been observed in different studies that students who exhibit more ASRs during instruction learn more than those who exhibit less ASRs and consequently perform better academically (Heward, 2009; Heward et al., 1996).

In the field of pedagogy, units of learning (ULs) have recently been proposed as basic units for measuring learning. These are defined as chains of instructional operant which incorporate the specific interactions that occur between learners and teachers and predict whether learner behavior will be controlled by the contingencies that occur in the educational context rather than by other issues (Greer, 1994). To date, however, few studies have investigated how the implementation of such

learning units affects the academic performance of learners such as university students. As already discussed, it is necessary to give the learner agency and for the learner to react to the ULs by contributing active responses during the instruction (Malott et al., 1995). But for these responses to occur, learners must be given opportunities to respond. Response Opportunities (ROs) are stimuli provided by the teacher that promote student participation during instruction (Heward, 1994). An RO is defined as a measure of the "interaction between: (a) the teacher's instructional antecedent stimuli (the materials presented, the stimuli, the questions asked, the cues to respond) and (b) the teacher's success in getting students to respond academically in ways that are appropriate" (Greenwood et al. 1984 in Bahadourian et al., 2006). Although some authors distinguish between RO and ASR, they are both really interrelated components of the UL. In other words, the ~~RO~~ is the second component of the UL, alongside the ROs provided by the teacher (Austin, AQ3 2000; Bahadourian et al., 2006; Heward, 1994; Kellum et al., 2001; Malanga & Sweeney, 2008).

One procedure for increasing ROs is to include Review Questions (RQs) during and/or at the end of lectures. RQs help students to better understand the information received (León et al., 2002). They also make it possible to evaluate the respondent's level of understanding and to analyze the teaching–learning process taking place in the classroom (León & Escudero, 2003).

RQs both during and at the end of lectures are an effective resource in the formative assessment of students, especially in situations with large classrooms such as those found in the university context (Miller & Shulka, 2008). They engage students with the class content, allowing for immediate feedback from the teacher. In turn, the students' responses provide the teacher with feedback on whether or not his or her explanations have been appropriate. Research has shown that RQs are particularly effective in a multiple choice, true or false and/or short question format (Kellum et al., AQ4 2001; Marmolejo et al., 2004; Short & Martin, 2012) (Table 1).

Considering the learning unit, the RQs (instructional antecedent stimulus) would be a possible response opportunity offered by the teacher. As for the possible responses by the students (ASR) and considering the strategies collected in the scientific literature to increase the ASR, the use of response cards stands out (Tincani & Twyman, 2016). Response Cards (RCs) are an instructional strategy with empirical evidence that promotes active student engagement and improves academic performance (Cassell, 2016; Christie & Schuster, 2003; Clayton & Woodard, 2007; Lambert et al., 2006; Kellum et al., 2001; Malanga & Sweeney, 2008; Marmolejo et al., 2004; Munro & AQ5 Stephenson, 2009; Randolph, 2007; Schnorr et al., 2016; Tincani & Twyman, 2016). RCs are "cards, signs or items (whiteboards) used by students simultaneously to participate in class and respond to questions or problems posed by the teacher" (Heward et al., 1996, p. 5, in George, 2010). Students respond to the teacher's questions by holding their cards up, thus visually indicating their response to the question. The teacher can then quickly determine the student's performance, noting when the student responds with the correct answer and correcting them when the answer is not correct. This is especially useful in university contexts where the number of students is often high. Another advantage of RCs in relation to students is the peer-to-peer modelling that

Table 1. Contingency of 3 Terms in the RQ.

Terms	Participant
Instructional antecedent: Teacher's question	Teacher/RO
Student response	Student/ASR
Teacher's feedback	Pupil/teacher

they establish (Lambert et al., 2006). RCs also help motivate less participative students and serve as feedback for the risk of making mistakes (Lambert et al., 2006). The use of RCs among non-compulsory higher education students has been found to increase the frequency of class participation, the number of students participating (Narayan et al., 1990), and students' scores on written assessment tests (Cavanaugh et al., 1996; Clayton & Woodard, 2007; Kellum et al., 2001; Malanga & Sweeney, 2008; Marmolejo et al., 2004; Shabani & Carr, 2004).

As already mentioned, interactions between university lecturers and their students are often inhibited among other reasons because using instructional methods such as the lecture, where the lecturer explains, and the students take notes. In this context, there is generally little RO on the part of the lecturer and little ASR on the part of the students. Together with the large number of students per subject and the tight timeframe of the semesters, this sometimes makes it difficult to implement a methodology focused on learning rather than on the final assessment. It is therefore important to consider techniques such as RQ and RC as they may be useful in maintaining student engagement, as well as considering this context (university) an easier and more compelling environment for the realization of socially relevant learning.

To date, the results of different studies in university contexts have been conclusive in affirming that RCs and RQs increase the ASR (Clayton & Woodard, 2007; Kellum et al., 2001; AQ6 Malanga & Sweeney, 2008; Marmolejo et al., 2004). Most studies have related the use of CR and RQ to an increase in students' accuracy: that is, an improvement in the final exam scores (Clayton & Woodard, 2007; Kellum et al., 2001; Malanga & Sweeney, 2008; Marmolejo et al., 2004; Shabani & Carr, 2004). However, only a few of them have compared the RQ with the RQ + RC (Clayton & Woodard, 2007; Shabani & Carr, 2004) but the data are inconclusive. In one of them (Shabani & Carr, 2004), two experiments were performed in two different classrooms; experiment 1 compared two classrooms, one where RQ + RC and one where standard lesson was applied; experiment 2, three conditions were compared, RQ + RC, RQ only and standard lesson. In both experiments the ASRs were increased in the RQ + RC and RQ-only conditions, but there was no conclusive data on the accuracy of the students' responses. One of the possible reasons could be that each condition was performed by different teachers and by different groups of students. Therefore, more research is needed to ensure internal validity, and the relationship between accuracy responses, Ros, and ASRs, considering procedures such as RQs and RQs + RCs. It is necessary to observe the effect of the combination of both procedures and how these ULs (RQs vs. RQs + RCs) have a positive effect on the accuracy of students' test scores.

Therefore, it is necessary to work on the application of these instructional procedures in different cultural contexts to help generalize and disseminate the results and thus promote their social acceptance in different cultures and communities. One of the innovations of the present work is to hypothesize that the use of ULs (RQ vs. RQ + RC) promotes ASR (without the need for teacher RO). Another hypothesis is that the use of RQ + RC will be more effective than the use of RQ in terms of student performance on tests. And another hypothesis is that when ASR increases due to the use of RQs and RQs + RCs, unscheduled ASR will also increase.

The aims of this study were to compare the use of Review Questions (RQ) with the use of Review Questions + Response Cards (RQ + RC) in a university context to observe which procedure increases Active Student Responses (ASR); to test which of these procedures improves the accuracy of students' test scores; and to observe whether untimed ASRs increase under both experimental conditions (RQ vs RQ + RC).

Method

Participants and Context

The study was carried out with sixty-seven students enrolled on the Behavioral and Personality Disorders (Specific Educational Needs and Attention, SEN) course in the fourth year of the bachelor's degree in Primary Education at a Spanish public university. The participants were 13 men and 54 women aged between 21 and 25 years and mainly from the autonomous community of Andalusia (Spain).

Dependent Variables (DV)

The dependent variables were the number of ASRs (raised hands, RCs, comments, or oral responses to questions posed by the teacher, raising of doubts, etc.) (George, 2010) observed in the lectures and the scores obtained in the exams on the content taught in those sessions. Examples of exam questions: "The frequency criterion for considering anorexia or bulimia disorder is (a) 1 time every 3 months; (b) times a week for 3 months; (c) week in 3 months; (d) times a week for at least 3 months; ", "Anorexia and bulimia are chronic eating disorders. False or True", "Point out the characteristic that refers to retentive encopresis: (a) Defiant or antisocial response; (b) Multiple episodes of soiling; (c) Normal stool appearance; (d) None of the above is true."

An ASR was defined as the motor behavior of raising a hand, raising an RC, responding orally to a question asked by the teacher or making comments related to the explanation: for example, "What does it mean that the child…?", "Could you give an example of that behavior?", "How could I improve the child's behavior?", "Something similar happened to me when…", "I had a child once in the practice…", etc. The total ASR score for each session included: the number of hands raised, the number of RCs raised, and the number of times students participated in an unscheduled way. This number was divided by the number of students attending each lecture session to obtain an average ASR value.

Test scores were also considered as dependent variables. These were counted individually according to the percentage of correct answers, calculated automatically by the application used to collect the answers. It is necessary to point out that the scores obtained in the different exams were not part of the final evaluation, they were voluntary, since at the university it was not allowed to take exams outside the established period. They were encouraged to participate by emphasizing a continuous study of the subject. The ROs given by the teacher were also observed and counted, to be able to compare them with the ASRs. These ROs were mostly given orally in the form of questions during each teaching session: "Does anyone have any questions?", "Any doubts?", "Can anyone summarize what we talked about in the previous session?", "What disorder is characterized by ……?", "What model are we referring to when we talk about ……?", "What is the relationship between . ..?", etc.

Independent Variables (IV)

Review Questions (RQs) or Scheduled Questions. The RQs were designed to be presented during the lectures and were based on the content explained in the sessions using Power Point presentations. Before explaining each topic, the teacher developed seven review questions: 3 true-false (Example: "The prevalence of encopresis decreases with age"; "Children with rumination disorder have growth problems"). and 4 multiple-choice questions (a, b, c, d) (Example, 'Tick the wrong

answer to prevent obesity: (a) making mealtimes enjoyable; (b) eating exceptionally low-calorie foods; (c) avoiding snacking; (d) daily physical activity'; when we talk about school phobia, we talk about a type of phobia: (a) specific and/or social; (b) social and/or family; (c) contextual and/or family; (d) social only"). These were presented in writing in a PowerPoint presentation during the lectures (except during the baseline period).

Unscheduled Questions. Are questions that appear spontaneously during the lecture. "Does anyone have any questions?", "Any doubts?", "Can anyone summarize what we talked about in the previous session?", "What disorder is characterized by …?", "What model are we referring to when we talk about ..?", "What is the relationship between . ..?", etc.

Response Cards (RC): the RCs were a way of responding to the RQs programmed by the teacher and posed during the masterclass.

Materials

Paper log sheets were used to collect the following data each day: date, number of attendees, scheduled, and unscheduled ASRs (RCs, raising of hands, answering questions, etc.), and the number of ROs the teacher gave the students (Greer, 2014).

In the RC condition, students were given laminated cards to respond to the RQs posed by the teacher. They colored the true option green and the false option red (see Figure 1). Each RC face also contained the letters "a", "b", "c" and "d" to answer the multiple-choice questions.

The study was carried out during master classes or lectures. These sessions lasted 90 min each and took place twice a week in a faculty classroom.

Structure of a Standard Lecture Session. A new topic was started or continued. Most topics covered 2 to 3 lectures. As this was a university context, it was not possible to control the difficulty of the

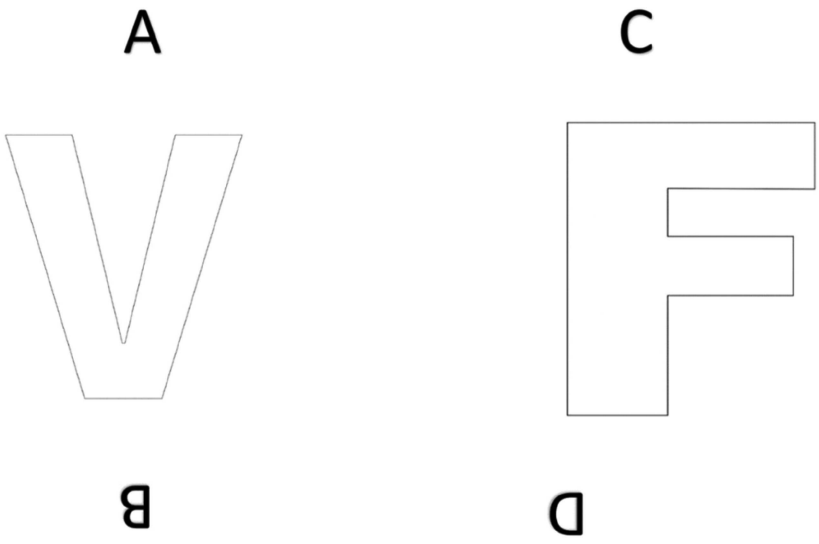

Figure 1. Response card (adapted from Marmolejo et al., 2004).

topics presented. This was due not only to curriculum planning at the regional level, but also to the difficulty of controlling the personal variables that can influence whether something is easy or difficult. During the master class, the teacher asked unscheduled questions or previously scheduled RQs. The unscheduled questions were questions posed informally to the students (see the examples in the Dependent Variables section). The RQs were prepared before the lessons, posed during the presentation, and had a closed format (i.e., multiple choice and/or true/false). These RQs were only presented during the experimental phases. The unscheduled questions (RO) were presented during all phases, both in the BL and under the experimental conditions.

Structure of Exam. 10 questions on the content of the topic taught in the lectures. On all occasions, each questionnaire included two gap-fill questions, four true-false questions and four multiple-choice questions (the format was identical in the different conditions). Since the exams was administered using the online application Socrative, the students needed technological support (mobile phone, tablet, or computer) to be able to complete it.

Both the RQs posed during the lectures and the questions in the written questionnaires were checked by a person other than the teacher. This person verified that the questions and correct answers were properly worded, and representative of the content explained in the sessions. The questions, in both cases, had to deal with the same content, they had to have the same format, but they had to be different.

The teacher in charge of conducting the procedure is the first author of this article. She holds a PhD, a degree in Psychopedagogy, and is currently studying for BCBA certification. At the time of the study, she had more than 10 years of experience in teaching and research.

To capture a full view of the classroom quickly and easily, the sessions were recorded with a GoPro-type video camera. To be able to observe all the students and not lose any information about the ASRs emitted, the camera was placed on top of the blackboard. As it was small, it was hardly noticed by the students.

Experimental Design and Procedure

All procedures performed in studies with human participants were in accordance with the ethical standards of the institutional and/or national research committee and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The ethics committee of the University of Cordoba gave its approval on 22 May 2020.

The research was conducted using a baseline alternating treatments research design (BL/RQ + RC/RQ). Unlike other approaches, such as reversal designs, this design allows functional relationships to be demonstrated between independent and dependent variables in a short period of time. Considering the scheduled sessions of the subject (10) and the baseline data, the presentation of the conditions was quasi-randomized. That is, before starting to alternate treatments, it was planned that each condition would have the same number of sessions (3) with their presentation being randomized. The teacher received a message via WhatsApp 1 min before the start of the lesson telling her which intervention to use for that block of content: for the RQ + RC intervention, she distributed the RC and used the 7 RQs, while for the RQ intervention, she only formulated the 7 RQs and the students answered by raising their hands.

Experimental condition 1: RQs were presented during lectures and ASR were considered only their raised hands. Experimental condition 2: RQ + RC. In this condition, the planned RQs were presented together with the RC as a method of student response. In this case, ASRs were only

RC, no one raised their hands, everyone used RC. The students displayed the card with the answer they had chosen facing forwards.

As mentioned above, exams were given at the end of each content block via a freely accessible virtual platform (Socrative).

At the beginning of the course, students signed a written informed consent to their participation in the research. This reminded them that their participation was voluntary and informed them that it may be recorded in accordance with the ethical guidelines governing this type of work.

Baseline (BL). During the sessions, data were collected on student attendance at each lecture session, the frequency of unscheduled ROs by the teacher and the frequency of ASRs given by the students. During the BL, exams on the content explained were carried out at the end of each topic using the above-mentioned application. Failures were not deducted from the marks, so the student had to get 75% or more correct answers for the content to be passed. Students had a maximum of seven minutes to complete the test. No RQs were given during this phase, but the teacher did offer unplanned ROs (for example, does anyone have any doubts?).

Intervention. In this phase, the teacher provided a series of ROs in the form of RQs and other unplanned ROs, as described in the Dependent Variable (DV) section. These questions were asked during the explanation of the content. Each question was read twice, and each answer option was repeated three times to help students remember the different options. All other forms of response continued to be recorded and were considered as a further form of participation. In the two treatment conditions (RQ; RQ + RC), students took online exams after each content block, just as in the baseline. The questions included in the final questionnaire were different from the 7 RQs that were asked during the lectures.

RQ Condition. When the teacher asked the question, students responded by raising their hand to the option they thought was correct (E.g., "Who thinks A is the correct answer?"). In this case, all answer choices were presented using a separate question (E.g., "Who thinks this is true?" and "Who thinks this is false?") and students responded by raising their hands. After approximately 30 s, when all students had been given the opportunity to answer the question, the teacher would indicate the correct answer. If 75% of the class had answered correctly, the teacher continued with her explanation. If less than 75% of the class had answered correctly, the teacher reviewed the material.

RQ + RC Condition. During the first RQ + RC intervention session, the teacher taught the students how to respond to the RQs using the RCs. Students were told to answer the questions by clearly showing the card with the answer they thought was correct facing the teacher. After a few seconds, the teacher counted the correct answers, and the students lowered the RCs. As in the previous condition, if 75% of the class answered correctly, the teacher continued with the explanation of the content. If less than 75% of the class answered correctly, the teacher reviewed the previously explained material. The review consisted of a brief (two or three sentence) explanation of the content of the question.

Inter-Observer Agreement

Seventy percent of the sessions were videotaped. The remaining 30% were lost due to technical problems. The teacher and an independent, previously trained observer observed the students'

ASRs (raised hands, RCs, or oral interruptions, etc.). In addition, in case of technical failures with the camera, the teacher collected the information on the recording sheets described above. Both the learning opportunities provided by the teacher and the ASRs given by the students were recorded. For the ASRs, inter-observer agreement data were calculated for 90% of the baseline lectures and AQ7 for 85% of the intervention sessions (Cooper et al., 2019). For the exams, the online platform itself corrected the questions based on the correct answers given by the students. Average agreement for these tests was 100%. The total number of ASRs in each lecture session was counted by each of the two observers. Agreement per class session was calculated by dividing the lowest frequency by the highest frequency and multiplying by 100%. Reliability was calculated for each session by considering that session as the time interval in which the behaviors were recorded, obtaining a mean observer agreement for those intervals. The mean agreement for student participation was 90.12% (range, 75%–100%) at baseline and 99.28% (range 98%–100%) for the intervention sessions.

Data Collection and Measures of Effectiveness: User Satisfaction

To assess the social validity of the study, a questionnaire with dichotomous response questions was designed. This was done in general, not asking about RQs, on the one hand, and the combination of RQs + RCs on the other. The questions included were: "Have these instructional strategies improved your attention in class?"; "Would you like other teachers to use them in their classes?"; "Have they improved your academic performance?"; "Would you use them in your practice as a teacher?", and, finally, "Do you think it is an appropriate practice in a university setting?"

Results

Considering the first objective, which was to compare the use of RQs with the use of RQ + RCs to observe which procedure increases scheduled ASRs, Figure 2 shows the average ASRs per student in the different phases of the intervention. In the BL, we see a low average participation of students

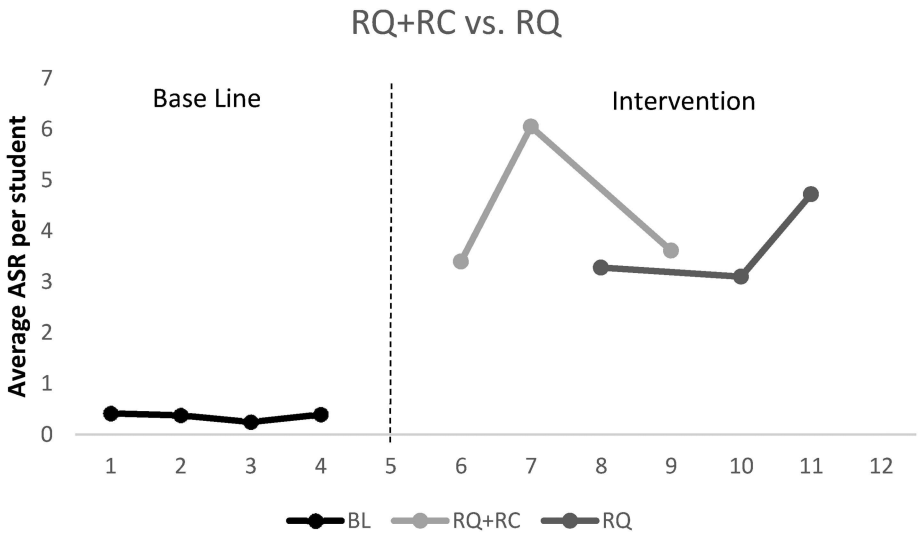

Figure 2. Average ASR frequency per student in each phase of the research.

and a certain stability in the data. With the introduction of both conditions, RQ + RC and RQ, a considerable increase in ASR can be observed. Comparing the two conditions, the RQ + RC condition implies a higher increase in ASR compared to the RQ condition. In both conditions, however, some variability can be observed in the data. During the BL, the average number of responses per session was 0.35 (0.24–0.41). During the RQ condition it was 3.7 (3.1–4.7) and during the RQ + RC condition it was 4.35 (3.4–6.04).

In Figure 3, we see the average participation in each phase of unscheduled ASR, and the comparison with the RO given by the teacher. In Figure 2 it can be seen how the average ROs in each of the phases were constant, but the average unscheduled ASRs were nevertheless more frequent in both the RC + RQ and RQ phases. Graph 3 shows a consistent upward trend in the data.

Regarding the second objective, which was to check whether the use of these procedures improves the accuracy of the students' exam ~~scores,~~ Figure 4 shows that, in general, the results indicated an improvement in the RQ + RC condition, where there was a higher average percentage of correct answers by students than in the other conditions. Average ~~scores~~ were 68.97% (59.1%–78.3%) in the BL, 61.20% (46.9%–69.21%) during the RQ condition, and 79.02% (74.8%–83.63%) during the RQ + RC condition. Although considering the 75% criterion for passing the questionnaire, it can be said that in the RQ + RC condition the results were slightly more positive. In the graph, it can be seen how the ~~results~~ in the exams were always above this criterion in the RQ + RC condition.

Social Validity Results

As mentioned in the section on procedure, at the end of the study the students completed a questionnaire designed to assess the social validity of the procedure. When asked whether the RQ + RC had improved their attention in class, 97.82% of the students answered yes; 97.82% answered yes

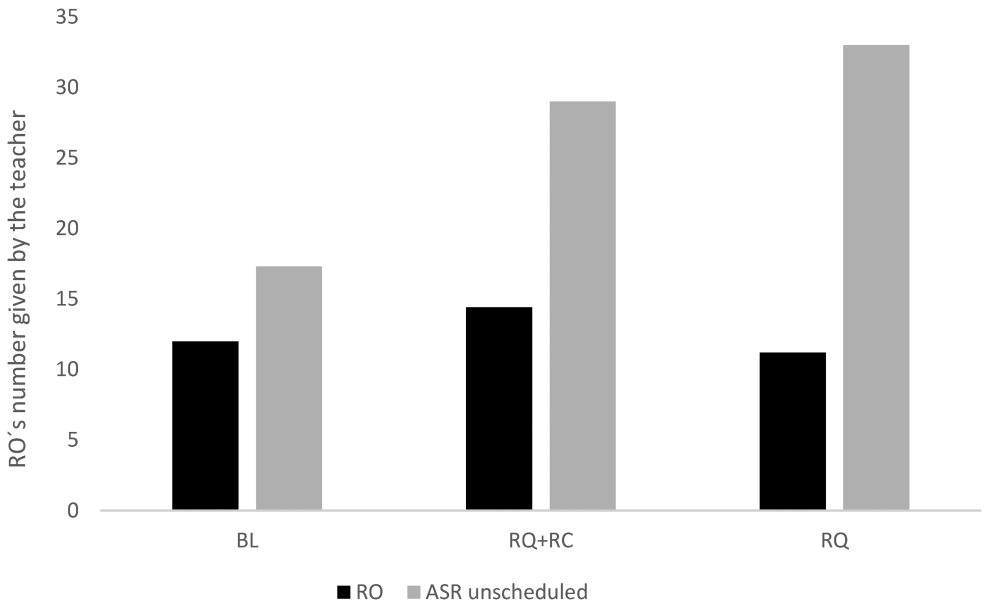

Figure 3. Comparison between the ROs given by the teacher and the unscheduled ASRs made by the students in each phase.

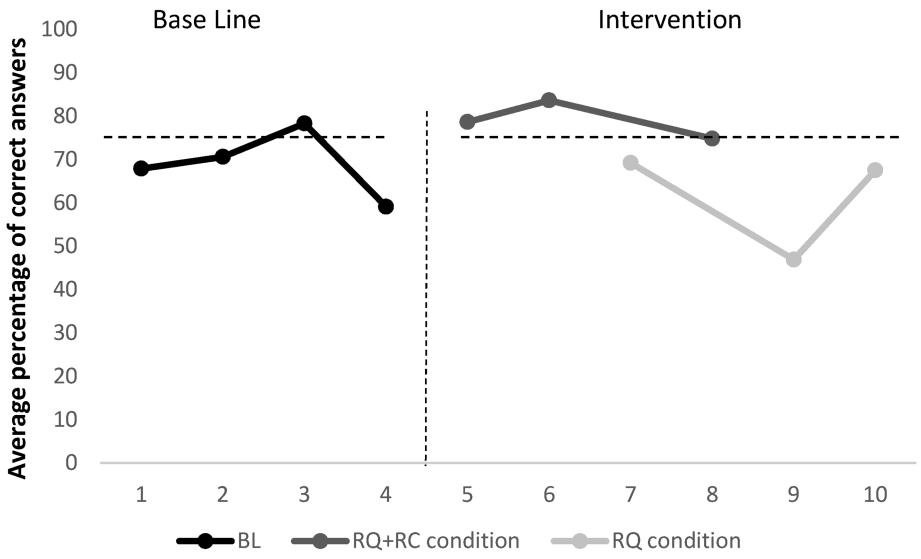

Figure 4. Average percentage of the correct answers of the class group in the final exams.
Note. Dashed line marks the minimum 75% that had to be achieved to pass the test.

Table 2. Questionnaire to Assess the Social Validity of the Procedure.

Ítems	%
Have the RQ and RC improved your attention in class?	97,82%
Would you like other teachers to use this procedure in their classes?	97,82%
Did the RQ + RC improve your performance in self-assessment tests?	84,78%
Would you use them in your teaching practice?	95,65%
Did you enjoy using RQ and RC?	95,65%
Do you think this is an appropriate university practice?	93,5%

that they would like other university teachers to use the RQ + RC in their classes. When asked if it had improved their performance in the self-assessment tests, 84.78% said yes; 95.65% said they would use it in their teaching practice; 95.65% said they liked the procedure; and 93.5% said AQ8 they thought it was a practice suitable for use at the university level (Table 2).

Discussion

Regarding the first objective of the research, to compare the use of RQs and RQs + RCs with the use of RCs in a university educational context to observe which procedure increases ASR, it can be said that it was fulfilled. The combined use of RQs and RCs and the exclusive use of RQs can be said to have been effective in increasing ASRs during master classes. However, the differences between the two conditions, as can be seen in Figure 2, are not too large. If the results of each condition are compared with the baseline, an increase in active student participation is achieved. These results are consistent with other studies (Clayton & Woodard, 2007; Kellum et al., 2001; Shabani & Carr, 2004) although in this case aspects related to internal validity have been controlled.

It is possible that performing RQs in both conditions positively influenced the ASR performance, regardless of the use of RCs. This type of instructional antecedent stimulus may have exerted a positive, motivational influence on students' active participation. One reason for this may have been the relationship between the RQs and the questions asked in the exams. In that case, this situation may have acted as a setting operation for increased participation in class. Some authors also point out (Shabani & Carr, 2004) that this lack of difference between the two conditions may be since raising one's hand and using RC is a friendlier and more pleasant way of showing ASR than doing it individually in front of 40 or 50 people.

Regarding the second objective, to observe which procedure most increases Active Student Responses (ASRs), to verify whether the use of these procedures improves the accuracy of students' exam ~~scores,~~ it can be said that there were differences between the baseline data and the RQ + RC condition, being the ~~scores~~ higher in the intervention phase; in the case of the RQ condition versus the baseline, there were differences but in this case the baseline data were better; on the other hand, between the RQ versus RQ + RC conditions there were differences being higher the ~~scores~~ in the RQ + RC condition. This result coincides with some research where the differences between the baseline and both conditions were close to those of this research (Clayton & Woodard, 2007; Shabani & Carr, 2004). This may have been due to the variability of the content and the complexity of each of the topics. Some students may find some topics more difficult than others. The difference in content is a difficult variable to control in the university environment. Another aspect that may have influenced these results is the fact that the exams were voluntary, they did not contribute to the final ~~scores~~ (Short & Martin, 2012), causing students not to engage with the exams. As already explained in Variable Dependent and the lecture procedure, the University itself does not allow exams to be taken outside the established period. In the future, it would be convenient to request permission for these exercises to count in the final grade of the course. Perhaps if these exams were summative there would be a greater engagement and involvement on the part of the students. Considering the informal observation, it should also be noted that sometimes the students were more concerned in copying the questions of the questionnaires than in answering them, which could also have influenced their answers. Despite the results, and the fact that the differences between the conditions are small, based on the 75% criterion it can be said that the most favorable condition appears to be the RQ + RC. With respect to the differences between the baseline ~~scores~~ and the RQ condition, a possible explanation for the better ~~results~~ in the baseline is that during the baseline more students attended class because it was the beginning of the term, and the contents were more accessible because they corresponded to the introduction of the subject. Fortuitously, the sessions of the RQ condition were evaluated last. It is possible that the students were pending other subjects and could not dedicate all the time to attend and study the subject of this research. It is possible that they attended only on the day of the exam and missed the rest of the training sessions. As attendance was not controlled in a personalized way, this situation could have affected the data for the RQ versus LB and RQ + RC condition.

Regarding the third objective of the research, to observe whether there is an increase in the performance of non-scheduled ASRs, it can be said that it was fulfilled. In this case, there are no studies with which to contrast these results. Considering the ones, it can be said that both conditions were found to have had a positive effect on such responses. The variability of the responses may have been reinforced by the demand for information in each specific content block. It may also have been influenced by students' inconsistent attendance at class. Students tend to be absent when the end of the subject course—and, therefore, the term's final exams—are approaching.

In terms of the social validity of the independent variable, the results were positive. Practically all the questions were answered affirmatively by more than 90% of the participants.

Most of the limitations of this study constitute areas of improvement for future work. One such limitation was the lack of time: the study had to be adapted chronologically to the four-month time (15 weeks). Together with the need to stabilize the BL data, this meant that it was not possible, for example, to carry out a reversal experimental design (ABAB). A multiple baseline design across subjects, or even starting the intervention directly without collecting LB data, could also have been considered. This stabilization may have been influenced by the fluctuating number of participants in class, as attendance at the lectures was voluntary. In the future, it will be necessary to establish procedure to ensure that students' attendance is maintained over time. Another limitation of the work was the use of an online platform for administering the exams. Although this was very useful due to its objectivity and the ease with which each participant could complete the test and all the ~~results~~ could be collected, problems sometimes arose due to failures in the campus Wi-Fi network. In addition, for future research it will be necessary to evaluate the social validity of the participants considering the two conditions, on the one hand the use of the RQ and on the other, RQ + RC. In this case, only the satisfaction of the participants in general was evaluated.

As future lines of research, it would be interesting, for example, to allow more time and to increase the number of sessions for each of the conditions in the intervention. It would also be necessary to guarantee the students' attendance over time, perhaps by including a reinforcement program; to carry out another type of research design that would give the results greater temporal stability and make it possible to observe their generalizability to other contexts. It would be interesting to implement research designs that analyze the components of the RQ and RC procedure in isolation: the number of RQs, teacher influence, etc. It would also be interesting to observe the impact of using RQ + RC on variables such as time on task and student disruptive behavior. These variables are of the utmost importance in the teaching–learning process, especially in compulsory educational contexts.

Conclusions

It is a reality that the use of digital technology is increasingly present in university lectures. Being an academic involves working online with both peers and students. In fact, in this research we have used common digital resources in the classroom dynamics, such as Power Point presentations and other more innovative ones, such as online exams through the Socrative platform. Following the paradigm SoTL, the use of technology is an aspect that must go along with pedagogical innovation (Barrientos Amador & Aucoin, 2018; Roughley et al., 2021). This innovation should not only occur through the use of digital resources, but it is also important to implement innovative pedagogical strategies with empirical evidence such as QRs and RCs.

It is important to point out the advantages that this type of procedure offers the university student: it helps the student to make better use of class time; it is an opportunity for self-evaluation, both of knowledge and understanding; it helps the student to orient his own learning, to know where he needs to improve; favoring learning by processes can help the student to assimilate contents from one year to the next, which greatly facilitates the construction of an academic program with interconnected contents taught in different courses; It allows doubts to be raised and resolved at the end of the class; it increases students' attention; it serves as a summary of the class, recalling and consolidating content; and it helps students to learn part of the important content to be included in the final exam. This type of procedure also has a number of advantages for the teacher: serves as a review of the contents taught, facilitating immediate feedback from the students (high number of correct answers, means that the contents have been understood, and low number of correct answers, means that the contents have not been understood and therefore it is necessary to

improve the lecture); it helps to improve the master classes of future groups, since it allows the teacher to focus on the contents that the students find more difficult to assimilate; it can be included during or at the end of the master class, so as not to have to change so many things a priori in the planning phase of the subject; and these innovations are even easier to carry out with the help of digital technology.

In conclusion, RQs and RQs + RCs are an instructional procedure that effectively promotes scheduled and non-scheduled ASRs. They are easy to implement, low cost, fun for all involved and adaptable to different contexts. As some authors have already pointed out, it is very interesting for future primary school teachers to observe this type of procedure during their university training (Christie & Schuster, 2003; Narayan et al., 1990) and to consider the possibility of including this type of strategies in their training syllabuses (Randolph, 2007). On the other hand, it is necessary to continue investigating the relationship between ASR and students' accuracy in written exams. It is important to consider these techniques as a useful way to maintain students' engagement in study in contexts such as the university. It is in this context that relevant social learning can occur with greater facility and conviction.

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