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Research Article

Secondary Science Students' Conceptions of Assessment: A Case Study in Fiji

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Abstract

Early research on classroom assessment has shown that the student's voice is conspicuously lacking in the literature. Although recent studies have shown an emergence in students' conceptions of assessment, very little substantial research has been done in the Fiji Islands. Therefore, this study examined how Fijian secondary science students felt about current assessment methods and which ones they valued the most. This study was guided by sociocultural theory, which emphasizes teacher-student interaction, making it appropriate for science learning and assessment, and the measurement theory, since Fijian secondary schools conduct standardized testing. In this interpretive study, 60 secondary science students volunteered to participate and share their experiences with current assessment methods. In this case study, data was collected using semi-structured interviews, and content analysis was used to evaluate the results. This qualitative study found that science students have multiple conceptions of current assessment methods and prefer formative assessment to summative assessment. Because it offers guidelines on how assessments should be utilized in classrooms and how students learn best, this study is helpful to both students and secondary science teachers. To raise student achievement, the study suggests that further research be done on the effective use of alternative types of formative assessment.

Keywords

Assessment, Formative Assessment, Summative Assessment, Conceptions, Students

1. Introduction

Classroom assessment is an emerging topic of interest in the Pacific educational context. The term "assessment" has several different meanings. Brown and Hirschfeld [1] provide a useful definition of assessment as "the act of analyzing information based on student performance that has been obtained through any of a variety of techniques" [1] (p. 4). This term was useful in this study because it highlighted that a student can be assessed in multiple ways.

Assessment in the classroom can take a variety of forms. Some teachers may use a written test or examination to evaluate their students' performance, while others may use activities other than exams. A traditional type of assessment is the use of written tests or examinations, which falls under the summative assessment or *assessment of the learning* paradigm. Summative assessment comprises pen-and-paper assessments that use grades and scores against a standard to assess a student's performance [2]. Aside from traditional exams, contemporary assessment procedures include verbal questioning, presentations, group work, using portfolios, and conducting practical tasks. The formative assessment or *as-*

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sessment for learning paradigm encompasses several modern assessment strategies. Teachers and students utilize formative assessments to assist instruction and monitor student learning during the class [3]. However, Wiliam [4] and Bennett [5] agree that it is unhelpful, and simplistic, to equate assessment for learning with formative assessment, and assessment of learning with summative assessment. Bennett [5] suggests that assessments designed primarily to serve a summative function may also function formatively, and those designed mainly to serve a formative function may also function summatively. Assessment, in all its manifestations in the classroom, is an important component of learning and teaching.

While the type of assessment impacts a student's learning, the student's conceptions, beliefs, and feelings about the assessment method impact their desire to learn. Simply said, how students perceive the reasons for assessment impacts how much work they will put into the assessment process. For example, a high-achieving student may see assessment as a means of passing an examination and progressing to the next class level, and thus feel motivated to study for the exam to achieve the highest possible score. A low-achieving student, on the other hand, may have unfavorable conceptions of an examination because they believe that grades and marks in an assessment do not reflect their personality or sense of worth as a learner [6]. A student who has a negative attitude toward assessment may be unmotivated to study hard for the exam.

"Conceptions" of assessment have been defined as the way individuals view and feel about assessment based on their previous experiences of assessment [7]. Understanding students' conceptions of assessment in their learning and teaching has been an emerging area of interest in the domain of assessment research. Acknowledging the students' conceptions is vital as their beliefs and opinions guide and determine how they study [8]. Though this area of research has implicit benefits for the learning and teaching process, early volumes of research have shown that students' voices are conspicuously lacking, especially in the Pacific context such as in the Fiji Islands. Although recent studies by Brown and colleagues have shown an emergence in students' conceptions of assessment (e.g. [8-10]) no substantial research has been done with secondary science students. This gap in the assessment literature needs to be addressed because what students think and feel about assessment will facilitate their performance in science subjects and will have implications on how they will participate in assessment tasks.

Therefore, this research aimed to gather secondary science students' conceptions of current assessment and which assessment methods they prefer and value. The following research questions guided this study:

1) What are Secondary science students' conceptions of assessment?
2) Which assessment techniques are most preferred by Secondary science students and why do students feel that such assessments are useful?

This study is important because it helps science teachers gain a sense of awareness of which assessment methods are being valued by their students. On the same note, Guskey [11] reiterates the importance of assessment awareness for teachers as it serves as a source of information to identify strengths and weaknesses of their students' learning abilities as well as shifting science students' and teachers' assessment paradigms from traditional testing to contemporary methods of assessment.

2. Assessment in Fiji

The Fijian education system is governed and administered by the Ministry of Education (MoE). MoE oversees academic schooling from preschool to university level, with science subject specification beginning from primary school. Primary school students (Years 1 to 8) take Elementary science or Basic science subjects, whereas Secondary science students (Years 9 to 13) have a combination of Basic sciences, Biology, Chemistry, Agricultural science, Physics, and Food and Nutrition. The need to begin and administer assessment and examination in the Fijian curriculum is enforced by the Curriculum Advisory Services (CAS) and the Technology and Employment Skills Training (TEST) department. One of the most significant reforms implemented by MoE was initiated in 2015 and 2016, by which it was mandated that all students sit for an examination at the end of the academic year as a major assessment. These national examinations include the Fiji Year 10 Certificate Examination (FY10CE), the Fiji Year 12 Certificate Examination (FY12CE), and the Year 13 Certificate Examination (FY13CE). The Year 9 and Year 11 levels have standard internal examinations as part of their final assessment.

Projects, in addition to written exams, are part of the Year 12 and Year 13 levels. These projects are part of the subjects English, Home Economics, Computer, and Agriculture. Previously, project marks were included in the final assessment; however, beginning in 2016, the Year 12 examination for most subjects became a 100% written examination. As a result, Fijian schools place a high value on examinations, while other forms of assessment are mostly internal, or classroom-based.

The student participants in this study were chosen from a secondary school learning context ranging from Year 9 to Year 13. This study includes the conceptions of Year 9 and 10 students for Basic Science and Agricultural Science lessons, while senior students have shared their conceptions for other science subjects such as Biology, Chemistry, Physics, and Agricultural Science, which includes their practical lessons.

3. Theoretical Framework

When doing science, the emphasis is not on replicating methods used by scientists and the ability to reproduce existing results, but on investigation done by students them-

selves, which allows for first-hand experience. During scientific research or experimental work, students have complete control of the process with teachers acting as guides or facilitators of learning [12]. This notion is illuminated by the socio-cultural theory of knowledge, which serves as the current study's first theoretical framework.

This sociocultural theory of learning, postulated by Lev Vygotsky, construes that socializing with other learned individuals eventually leads to independent thoughts [13]. The learner internalizes the effects of learning as a joint body [14] and then acquires the knowledge needed. The interaction with their social environment and the learning that takes place between them is perceived to be a socio-cultural process. However, Vygotsky did not only focus on the extent to which the knowledgeable other influenced the interaction but also the learner's input in the interaction [15], which makes learning a two-way process. This notion appropriately lays out the foundations of the sociocultural theory in the current study by emphasizing the conceptions of science students on current assessment methods their teachers are using in class.

Together with this, measurement theory, or psychometric theory, includes the dimension of knowledge, abilities, attitudes, and traits with a numerical value. This theory provides the second framework for the current study, as the researcher, with a science teaching background, conducted standardized testing as part of her assessments of students. When test makers carry out tests in classrooms, they also set outscoring procedures for which theorists such as E. L. Thorndike have constructed models to account for how individuals may have performed. The mathematical theories of measurement will be emphasized in the current study because they are most applicable to teachers, students, and stakeholders in educational settings. Mathematical theory is primarily concerned with the numbers or values assigned to objects to represent their relationships. These values are used to assess students' ability or aptitude [16]. This can be accomplished in many ways, the most common of which is by analyzing the number of correct responses in a test and assigning a percentage or an aggregate mark. This theory is important because it informs students, teachers, and parents about their academic progress, which is related to a diagnostic function in assessment.

However, testing alone can have negative consequences, such as statistical errors in the score [17] and demoralizing low achievers [18]. Nevertheless, it is important to note that assessment is not always a psychometric process in which students' abilities are judged based on grades and scores, but rather a scientific process in which students' abilities are best represented in the assessment method that they perform.

4. Literature Review

Seminal works by Brown and colleagues [19] have identified multiple purposes of assessment, which include assessment for improvement purposes, diagnostic purposes, and assessment for accountability, assessments are enjoyable and beneficial, and assessments are irrelevant.

A recent study surveyed 612 student participants from a senior high school about their perceptions of assessment purposes. The assessment, according to the participants, helps them improve their work [20]. It was also discovered that performance was affected by the type of assessment used by teachers. Therefore, assessment improves, in fact, the student's cognition. Similarly, Fook and Sidhu [21] summarised how students gain skills in the classroom through assessment. For example, group discussions help students improve their interpersonal skills, recognise teamwork, and respect other people's ideas; writing journals allows students to enhance their critiquing and reflecting on personal experiences; and class participation helps them improve their oral skills and encourages cooperation. These are life skills that can help students prepare for work in various fields in the future.

The essence of maintaining standards, or accountability, is one of the most important purposes of assessment for an institution [22]. Students hold the belief that the evaluation provides school accountability because those who find assessment tasks fun and enjoyable believe that the school must be doing a good job [1]. According to Brown and Hirshfeld's [1] study, student conceptions are interconnected – that is, the 'assessment is fun' conception correlated significantly with school accountability. Of course, this depends on the school's assessment tasks. This study showed some variance from Brown and Hirschfeld's previous study where 'assessment is fun' had negative loadings on achievement. However, both studies concluded that students who take ownership of their learning by using the assessment formatively have increased performance.

Assessment, in addition to providing student and school accountability, also provides teacher accountability [23]. Teachers hold this view of accountability because it allows them to assess their work progress and determine whether their teaching strategies are beneficial to student achievement. Brown, Hui, and Yu [24] investigated the perspectives of Hong Kong primary school teachers on assessment. In addition to improving achievement, some teachers believe that assessment helps maintain personal standards. The study also discovered that such a viewpoint enables teachers to successfully implement and modify their assessment strategies.

In the Pacific context, emerging research has shown teachers' conceptions of assessment to align towards formative functions such as providing support for student learning, and measuring student performance [25]. However, no concrete data has been published regarding students' conceptions of assessment in science subjects, making this research the first of its kind.

Peterson and Irving [6] researched students' conceptions of assessment strategies and found that students hold teachers accountable for their poor academic results. Furthermore, some students in their study described the assessment as irrelevant because they found it unfair or bad. Several reasons were revealed through the study, such as subjectivity, unre-

liable scoring, and lack of professionalism from the teacher. Brown and Hirshfeld [26] justified students' negative conceptions of assessment by stating that assessment awareness develops in students over time, especially when transitioning from one level to the next. For example, noticeable changes occur when students transition from primary school to secondary education [27] and from secondary to tertiary education [6]. Some literature indicates that this could be due to increased awareness of the importance of assessment or tests as students get older [9].

Assessment serves a diagnostic function in educational practice as it allows teachers and students to measure their progress and identify areas of improvement. MacLellan's [28] survey of students' conceptions of assessment purposes perceived assessment to be diagnostic whereby limiting factors in learning are identified through teacher feedback and areas of focus could be given more guidance. More recently, Adarkwah [29] found similar assessment functions as students revealed the significance of detailed feedback, which helps them improve their knowledge of concepts, cause and effect relations, as well as analytical skills.

5. Methodology

5.1. Research Approach

This study adopted a qualitative or naturalistic approach to meet the research objectives. A qualitative or naturalistic approach includes research questions that focus on experiences, opinions, feelings, and knowledge which are collected by acquiring direct quotations from the participants. Therefore, a naturalistic approach satisfies the purpose of the study as the researcher, through in-depth interviews, does not attempt to influence the research objectives [30]. This means that the opinions and experiences of the participants are independent, and the meanings and interpretations of their words have been analyzed without bias.

The main advantage of qualitative research is that it can be conducted with small samples while also providing detailed information [30]. This benefit favors this study because it received a complete description and analysis of the subject without limiting the nature of any participant's responses [31]. This method was best suited to the study because it allowed students to articulate and "express" their concerns about assessment in science classes.

According to Patton [30], in qualitative research, the researcher serves as an instrument who interacts extensively with the participants. It emphasizes the researcher's role as an active participant [32]. Thus, in this study, the researcher served as both an instrument and an interpreter.

The researcher is both the data collector and the data interpreter and because qualitative research necessitates the researcher's contact with the participants and the situation under study, this could have negative consequences [30]. The researcher overcame this limitation by being conscious of her insider (teacher) and outsider (researcher) roles. The researcher ensured, as much as possible, not to let her teacher role influence the conceptions of her participants. This was done, for example using an interview schedule, where only important questions were asked.

5.2. The Pilot Study

Given that assessment can mean different things to different stakeholders, that there is a lot of confusion about its actual meaning, and that there is no agreed-upon definition [33], a pilot study with a small sample of students is deemed necessary. The goal of this exercise was to determine whether the student participants understood the primary interview questions before they could define assessment and list the assessment techniques they preferred. From this preliminary research, the researcher was able to revise her interview guide and manipulate the research questions in a manner that could be understood by the students.

Ten science students were approached based on their availability and verbal consent during recess and lunch time and were posed with a few questions on what assessment meant to them. As a result, all participants became confused at first and asked the researcher to rephrase her statement. Some claimed not to understand what the term 'assessment' meant. On the other hand, the rephrased question achieved better responses from the student participants. This was indicative to the researcher that the rephrased research question should be used during the actual interview.

5.3. Research Sample

A secondary school was chosen in Suva, Fiji, from which science students were approached as participants in the study. Students who participated in the study ranged in age from 14 to 18 years of age and were in Years 9 to 13. The study does not use real names. However, a coding system has been designed to label individual student participants. The researcher assumes that junior students (aged 14-15) are fresh out of primary school and may have different ideas about assessments than their senior counterparts. Given this assumption, the data analysis process divided the students into two subgroups: juniors and seniors. The junior student participants belong to the 'A' group, while the senior student participants are classified into the 'B' group. Numbers are used to indicate individual student participants; for instance, "student 1A" indicates the first participant in the junior category, and "student 15B" indicates the 15th participant in the senior category.

In total, 100 consent forms were distributed to students during their science classes. After their science teacher explained the purpose of the study, the ten students in the class were required to raise their hands in support of participating in the research. Of the 100 students who volunteered to fill out the consent forms, 72 received parental permission to partic-

ipate in the study. Sixty of these participants were interviewed based on their availability.

5.4. Data Collection and Analysis

Purposive sampling was appropriate for this study because the researchers wanted to select participants who had experience with science assessment and could provide in-depth responses to research questions. The researchers selected participants from different year levels to gain a broader understanding of current science assessment across different age groups. Morse [34] recommends at least 30-60 participants for semi-structured interviews because a small number of participants may yield "shallow" data. Therefore, by the 20^{th} – 25^{th} participant, the researcher noticed a trend in the data from both students' categories. As a result of this, there were 25 junior students (Level A) and 35 senior (Level B) students among the 60 participants.

In-depth, semi-structured interviews were chosen as a data collection method. Probing questions were also used to encourage participants to elaborate or clarify their responses [35]. To prevent intimidation of any of the participants, the researcher used a bit of informality in some parts of the interview while engaging with them. For example, use of vernacular language (Hindi language for the students who speak and understand Hindi). The interviews were conducted at a time convenient for the participants. When necessary, follow-up interviews were conducted.

In this case study, the use of open-ended questions in the interviews allowed flexibility and the potential emergence of unexpected themes and conceptions, which can enrich the findings of the study [36]. Research findings were organized into themes that provided insight into the participants' experiences, opinions, and understanding of science assessment. Content analysis was a suitable method for data analysis, as it allowed researchers to examine and analyze the data thoroughly, identify patterns, and draw conclusions based on the themes that emerged.

5.5. Ethical Considerations

Before beginning the data collection process, permission was obtained from the student's parents in the form of consent letters. Furthermore, prior approval from the Ministry of Education was obtained to conduct this research. As the school premises were being used and free periods were being borrowed, the Head of School from the school of interest was also consulted. Before agreeing to take part in the study, the participants were briefed on its purpose and goals. They were also assured that their contributions would always be kept strictly confidential, with an emphasis on the fact that participant information and opinions were being collected solely for academic purposes. The consent letters reassured them that their participation was entirely voluntary and that they could opt out of the study at any time. Furthermore, the interview was conducted cordially, with no participants being caused physical or psychological harm.

6. Findings

6.1. Senior Students' Conceptions of Assessment

The results obtained from the senior students revealed four types of assessment methods utilized in their science classes: being given a written test, conducting an extra activity in class, a presentation on a topic, and competing with other students through an exercise. Apart from these, two assessment purposes were also highlighted that is, evaluating oneself, and/or helping teachers evaluate their teaching methods. Students (n = 25) who mentioned sitting for a written test displayed a traditional interpretation of the assessment. One participant elaborated on its importance. For example, "a test will provide a picture of their ability and where students stand academically in the classroom" (Student 32B).

Other assessment methods and purposes such as doing additional activities, presentation, competing with others, and evaluating oneself that emerged from this category of participants leaned more towards contemporary conceptions of assessment. For example, formative assessment, whereby students are evaluated during the class. These formative activities include written quizzes (Student 5B), oral quizzes or questioning (Student 20B), or "pick-a-question" tasks from a container with written chits (Student 30B). Presentations meant that students had to present on a topic chosen by their science teacher. Some students mentioned that a presentation can be individual work or done in groups.

The least common view reported was that assessments help to generate competition amongst students. This assessment involved students writing questions for other students, from which they received scores for correctly answered questions from the teacher. Regarding self-evaluation, this conception, although said by a few student participants, is a 'form of understanding teachers background knowledge of their teaching methods and a way for teachers to understand what students think of their classes' (Student 26B).

When asked to define the term assessment, most of the senior students offered definitions that linked to the purposes of assessment. Purposes of assessment such as testing or ranking where one stands about the rest of the class were commonly noted. Students used terms and phrases such as 'test their knowledge' (Student 24B), 'to analyze' (Student 5B), 'to monitor' (Student 10B), 'to evaluate' (Student 13B), or to 'self-evaluate' (Student 20B) to share their understandings of the term assessment.

Several students hinted that assessment is resourceful for teachers. For example, 'someone who is assessing us wants to know which topics are difficult for us' (Student 26B). Therefore, it was evident from the senior student participants that they knew their science teachers used assessment as a form of feedback for their teaching. Some of the other feed-

back-related comments were as follows:

'It is defined as the means that a teacher uses to know how much a student knows' (Student 16B),

'The teacher wants to know if we have understood the concept' (Student 35B), and

'The teacher will test our knowledge on what we have done previously and test how much we know already' (student 22B).

Assessment was also defined to identify students' capabilities in class. For example, assessment is about 'assessing one's knowledge of a concept to identify the weaknesses to help them' (Student 13B). Similarly, 'we will know how much we know, what our weaknesses and strengths are' (Student 3B), and 'I can gauge how much I have learnt from my mistakes' (Student 9B).

Some students defined assessment as 'an additional activity or task' assigned to them by their teachers. According to these students, the additional tasks include tests, quizzes, group work, oral questioning, and written questions from the textbook were some of the examples mentioned. Two students briefly described what extra tasks they intended to accomplish:

'It is defined as an additional activity we do to help us better understand the topic and a way teachers test us on something we have been learning about, not just by seeing it in textbooks, but also in the demonstration' (Student 2B), and

'The assessment is like a task, or something given to us in order to deal with that particular topic that we have studied or familiarize ourselves with something' (Student 14B).

All senior students agreed assessments to be beneficial, and motivated them to do better, helps gain more knowledge, helps them recall information, prepares them well for the upcoming examinations, builds their confidence in learning as well as compares abilities with other students. Of these conceptions on the usefulness of assessment, the most common belief was that the assessments helped them gain more knowledge in their science subjects. This was further elaborated by a few students in terms of their practical component of science lessons.

'It becomes easier to understand most things, for example, through experiments…It is difficult to understand in theory, but once we have done the practical work, we can visualize, learn, and remember things as they happen' (Student 2B), and

'The best way is to do practical work...We understand more when we see and visualize things...We understand better when we perform group experiments and are evaluated in groups' (Student 23B).

Assessments are useful tools for students to help them recall information about previous knowledge. This was evident among the senior students, as assessments helped "train" (Student 28B) for upcoming examinations. Likewise, student 15B stated that;

'Assessments are good because it motivates us and give us a way to experience how questions can appear in exams or will be asked' and

'It tells us what we need to refer to or learn for exams' (Student 31B).

Other least common conceptions on the usefulness of assessment were also revealed among the senior student participants, such as that it boosts their confidence in class. This was in relation to presentations, as one of the senior students mentioned; 'It is good because it helps me remove stage fear during presentations and gives me confidence' (Student 19B). Additionally, it was revealed that the assessments allow them to compare themselves to other students. For instance,

'Assessments are good because they show us where we stand in class when we compare our marks with other students' (Student 20B), and

'Help me find out where I am standing before an exam' (Student 2B).

Assessments bring about different emotions in students; either positive, negative, or mixed feelings. Most of the senior student participants shared positive emotions about the assessments. They described their emotions toward the assessments as 'feeling good', 'fun', 'enjoyable', 'helpful' and "sufficient". For example, 'assessments make it enjoyable to study Biology' (Student 2B), 'makes science interesting' (Student 20B), and 'all assessments given are fun and sufficient' (Student 31B). However, this conception was evident among the students who performed above average in the class.

Some mixed feelings arose when asked about current assessments. Some senior student participants responded with 'nervousness' (Student 27B) prior to an exam, and it 'depends' (Student 28B), as students felt that prepared assessments were favorable to surprise assessments. On the other hand, some student participants had an overall conception of assessments. This was most common when it came to conducting laboratory experiments.

'I feel positive about theory and calculation, but I have a negative feeling about labs and experiments…When I do a lab, I feel negative because I am not sure if I am doing the experiments correctly' (Student 13B), and

'In labs, only the smarter students are encouraged; the others have no idea what is going on' (Student 34B).

Assessments were also negatively conceived if it puts pressure on the senior students, are unplanned, or do not improve their results. As Student 16B mentioned, 'Assessments are good to some extent, but if the student is under pressure, they are not very fruitful'. This participant went on to say that assessments (tests) can put him under stress if they catch him off guard or are given by the teacher unexpectedly with no prior notice. 'If told ahead of time, it's fine; surprise tests mess with the mind'. On the same note, Student 17B described unprepared or unexpected assessments as 'useless', because students would not perform their best.

The same interview questions were asked of the junior student participants in this study to understand their conceptions of current assessment methods.

6.2. Junior Students' Conceptions of Assessment

The junior student participants in this study had some similar conceptions as their senior counterparts, as well as a few different ideas. Just like the senior student participants, when junior students were approached with the first interview question on what they felt assessments were, they mentioned both traditional (summative) and contemporary (formative) conceptions.

Written tests and exams were identified as traditional views from the junior student participants, whereas presentations, extra activities such as quizzes, questions, lesson observation, conducting an experiment in the lab, and carrying out research work were seen as contemporary viewpoints.

It was interesting to note that all junior students mentioned "tests" in some part of their response when asked what they thought would happen if they were assessed in a lesson. Some examples include: 'It is defined as an examination or short test' (Student 2A), 'It is defined as an exam given by teacher on one topic' (Student 3A), 'It means topic tests' (Student 6A), and 'It means that we are about to do a test and we will be tested about a topic we have learnt' (Student 14A). Most of the participants elaborated on what they felt they would be tested on. A common answer was that they would be assessed on a previously learnt concept. For example, as Student 1A stated, 'We are going to have a test on whatever we have covered'. A few junior students mentioned why teachers would give them tests as an assessment. For instance, 'Tests are given to us by our teacher so that she can see if we are understanding what she is teaching us' (Student 5A). As a result, it is possible that junior students regard the term 'assessment' as a synonym for tests and exams.

In terms of contemporary methods of assessment, presentations were the most common. Some less common, yet noteworthy conceptions on assessment methods emerged from the interviews. This included going to the laboratory to conduct an experiment. For example, 'Experiments will be done' (Student 4A and Student 8A). Another less common assessment method was to attempt questions in class. For example:

> 'Questions will test our abilities, what we learn in class... more self-actualization... Questioning makes me realize my potential, and when teachers ask questions and I answer correctly, it gives me confidence' (Student 15A).

One discrepancy between junior student participants and senior students, albeit a small number of mentions, was that junior students identified experimental work and lesson observations as assessment methods. Lesson observations, according to the junior students, meant teachers assigning work for them to do while they monitor their progress by walking around the classroom or observing from a distance during independent and group activities. Here, the students may ask for help by raising their hand and the teacher comes to their group or desk and assists them.

When asked to define the term assessment, the junior student participants needed a probing question to help them understand what is asked, since the term assessment seemed ambiguous. Participants defined the assessment in multiple ways. These definitions included being given a test or exam, a means of testing your knowledge or determining how much you know (for example 'assessment means methods or ways that teachers provide to understand if we have understood what we have covered' Student 1A), a method used by teachers to gauge their students' understanding (for example, 'a type of test given to us by the teacher when they want to know how well we do in class or if we are attentive in class', Student 8A), a method of increasing learning (for example, 'Extra assistance given to students in their academic activity...for their future' Student 25A), a method of preparing for upcoming tests and exams (for example 'The teachers are implementing methods to help students memorize things for exams' Student 15A), carrying out science experiments, and to begin a new topic in class.

All junior student participants agreed that assessments are good, useful, and motivate them to do better. Because most junior student participants believed that assessment meant sitting for a test or exam, they believed that assessment was beneficial to them if it was for the purpose of gaining more marks (on tests or exams), improving the way test answers could be written, or preparing for upcoming tests in general. For instance,

> 'If we don't know a particular thing when we do those questions...there are some that might come up in the exam…we can learn how to properly answer that question through assessment' (Student 19A).

Furthermore, some students believed that assessments were beneficial for their science teachers in analyzing their teaching methods. For example, 'It assists teachers in finding a way to teach students of various levels' (Student 13A). This suggests that some junior students are aware that their teachers use assessment to evaluate their own teaching and develop appropriate assessment techniques for individual students.

Generally, positive emotions such as 'fun' and 'enjoyable' were expressed when describing how assessments made junior student participants feel. For example,

> 'I like to be assessed because it is quite enjoyable... when quizzes happen, and teachers ask questions, and we get it right... it is a boost of confidence' (Student 15A)

However, some junior student participants had mixed feelings about assessment. These mixed emotions included words such as 'sometimes', 'depends', and 'nervousness' to describe liking assessments only when they were ready for them. For example, Student 13A stated,

> 'In some cases, yes, I like assessments, in others, no... Sometimes it comes as a surprise, and other times we are prepared... I prefer it when it is planned, but surprises are also welcome', and
>
> 'It depends on how well I am doing in the subject or how much I like the subject' (Student 8A).

A few junior student participants expressed negative feel-

ings about the assessment in their science classes. These negative emotions were directed at specific assessment methods. For example, 'presentations are embarrassing' (Student 24A), and tests or exams made them feel 'scared' (Student 18A).

Therefore, multiple conceptions were collected from this study, some comparable, while some conflicting conceptions among the two categories of student participants.

7. Discussion

This study found that the students felt that assessments were given to improve their learning and valued the feedback they received from these assessments. This notion is comparable to Black and Wiliam's [37] belief in formative assessment that improves learning and development. Similarly, the expectation and value of feedback reflect the importance of assessment as a method for learning rather than for grading or evaluation, and that effective feedback is an essential element of student learning and achievement [38]. Students who value feedback, use assessment for improvement, and focus on their efforts rather than results are more likely to have a learning-oriented approach to assessment. This is a positive characteristic that can lead to increased motivation and improved academic performance. It is encouraging to see that some of the student participants in this study exhibit these learning-oriented goals.

The fact that students associated assessment with formative tasks that allowed them to interact with their peers and teachers suggests that they view assessment as an ongoing and interactive process that supports their learning rather than a one-off event that simply measures their knowledge. Therefore, the finding that secondary school science students value formative feedback is consistent with Maclellan's [39] survey, in which feedback plays a crucial role in helping students reflect on their learning and adjust their understanding of the subject.

It is interesting to note the diverse ways in which students perceive assessment. While some view it as a tool for self-improvement and identifying knowledge gaps, others see it to compete with their peers. This may be due to the competitive nature of the educational system, where grades and rankings are often emphasized. This aligns with the measurement theory, as assessment is seen as a means of grading performance or obtaining scores for achievement. However, it is important for teachers to emphasize the intrinsic value of learning and growth rather than external validation and competition. Teachers can do this by providing feedback that focusses on progress and improvement, rather than solely on grades and rankings. Additionally, creating a collaborative learning environment where students work together to achieve common goals can help shift the focus away from competition and toward shared learning. It is important to note, however, that healthy competition should not be the primary goal of assessment in science education. Rather, the goal should be to create a supportive learning environment that encourages students to take risks and learn from their mistakes [37]. Various literature dictates that teachers should strive to create an assessment culture that is focused on learning and growth, rather than competition and comparison [37, 38]. This can be achieved by formative assessment strategies that provide students with ongoing feedback and opportunities for improvement, as well as the use of summative assessments that are aligned with clear learning objectives and that provide students with a fair and accurate representation of their learning.

Many of the senior student participants in this study defined the assessment formatively, using terms such as 'evaluate', 'analyze', 'gauge', and a 'means to improve'. This is consistent with the findings of this study, where the students expressed that the assessment helps them understand what they need to improve and guides them to take corrective action.

Moreover, this study's findings suggest that students generally have positive conceptions of assessment, which contradicts the negative perception that some researchers have reported in the literature [6]. This finding is significant because it highlights the importance of using assessments as a tool to promote student learning, rather than as a means of measuring performance. For example, emotions such as 'feeling good', 'fun', 'enjoyable', 'helpful', and 'sufficient' were expressed. However, it was discovered during data collection that most senior students who found the assessments enjoyable and fun were high achievers. A few junior student participants expressed negative feelings about performance assessment in their science classes. For example, 'presentations are embarrassing'. By understanding the beliefs and conceptions of assessment, teachers can use assessment strategies that promote learning and motivate their students.

The positive attitudes towards assessment observed in this study align with the findings of other studies, indicating that assessments can be a motivating tool for students. When students see that their performance is improving, they are motivated to try harder in the next assessment, which can lead to better learning outcomes. Furthermore, students who view assessment as a tool for self-improvement tend to have learning-oriented goals, which are positively associated with academic achievement [39]. This finding is consistent with Darmaji et al.'s [20] and Fook and Sidhu [21] research whereby students revealed an improvement in conceptual development through assessments.

According to Brown et al. [40], students can experience various emotions due to assessments. The current study found that some students expressed positive emotions using phrases such as 'positive', 'good', 'fun', and 'enjoyable'. Vogl and Pekrun [41] suggested that positive emotions can lead to positive self-evaluations, increased motivation to learn, and improved academic performance. When students associate assessments with positive emotions, such as enjoyment or satisfaction, they are more likely to view learning as a re-

warding experience rather than a chore. This, in turn, can increase their engagement and effort in learning, leading to better academic performance. Additionally, positive emotions can help reduce stress and anxiety associated with assessments, allowing students to perform better on the test.

This study found that high-achieving science students were more likely to have positive emotions toward assessments. Furthermore, many female participants described the assessments as fun or enjoyable, which is consistent with findings from a previous study by Brown and Hirshfeld [1]. However, the researcher did not account for gender differences in her study and did not draw any conclusions based on gender due to the higher number of female participants volunteering for the interview.

Some students in the study found the assessment to be 'interesting', possibly indicating that they were well prepared for it. The study found that students had positive perceptions of interactive assessments, such as presentations, quizzes, and experiments. This finding contrasts with Brown's [42] study, which found weak links between the 'assessment is fun' factor and interactive assessments. It is important to note that the students in this study valued interactive assessments.

The study's student participants had a negative attitude towards surprise assessments, which are given without prior notice. This is likely because unprepared students may struggle to understand the assessment criteria, leading to negative perceptions about the assessment process. Martos-Garcia et al. [43] suggest that negotiation and preparation of assessment criteria should occur at the beginning of any assessment process to prevent negative perceptions of assessment.

In addition, some students in the study reported experiencing negative and/or mixed emotions when it came to the assessments. They described feeling 'withdrawn', 'nervous', 'surprised', 'embarrassed', 'scared', and 'curious'. Although these emotions were not limited to one type of assessment, students tended to express them more frequently in relation to written tests. Although this study found a range of negative and mixed emotions associated with assessment, the literature suggests that 'anxiety' is the most reported negative emotion [44]. Zeidner [45] proposed that these negative emotions may be caused by a variety of factors, including excessive task demands, the design of the assessment, a lack of information about the assessment's requirements, and inadequate materials and grading practices.

To alleviate negative emotions such as anxiety about the assessment, teachers must provide detailed information about the assessment protocols, structure, and grading to students. The current study found that senior students had more negative emotions toward assessment than junior students, which is consistent with Brown and Wang's [46] research. This could be because senior students are more aware of the personal implications of their test results as indicated by Brown and Harris [9]. For example, Year 13 students are aware that they must score a result that will secure them a place in tertiary institutions the following year.

In this study, high school science students prefer formative use of traditional/summative assessments (such as short tests or topic tests) as well as contemporary assessments (such as quizzes, presentations, peer teaching, questioning, projects, and group experiments) in their science lessons.

Written tests were apparently mentioned as a preferred method of assessment by a large number of junior student participants. Surprisingly, despite not being high achievers, some participants mentioned tests as the best method teachers can use to assess science lessons. As a result, some students may prefer written assessments not because they are good at them, but because they are used to them [47]. Also, the researcher felt that science teachers in the current study do not use frequent formative assessment for junior level lessons and rely heavily on summative assessments, which is why the majority of junior student participants preferred traditional summative assessments.

Some junior student participants mentioned the formative use of summative tests, such as topic tests or short tests given at the end of a lesson or sub-strand. Younger students prefer traditional tests over contemporary assessments, possibly because they have had less exposure to novice assessments and are still tolerant of the assessment techniques used by high school teachers compared to their primary education. This relates to McSweeney's [48] study, which was mentioned in the literature review, and found that students are better prepared for traditional assessments such as tests or exams because novice or contemporary assessments lack clarity. The researcher in the current study believes that the lack of clarity in contemporary assessments is not the only reason junior student participants prefer summative assessments, based on her own teaching experience with junior students. She observed that junior students are less eager to attempt contemporary or performance assessments, owing to their shyness and lack of confidence in comparison to senior students. As a result, junior student participants who shared examples of contemporary assessments used by their science teachers, such as questioning, group discussions, presentations, quizzes, and peer-teaching, preferred smaller-scale assessment techniques. This could imply that students should be given the opportunity to demonstrate their ability on a variety of assessment techniques in order to form clear assessment preferences [48]. Perhaps if more diverse forms of assessments are introduced to young children beginning in primary school, they will have better conceptions of assessment preferences.

The study's findings revealed that both categories of student participants had more positive conceptions of including experiments or laboratory work as part of their assessment. This was due to the students' belief that science is a practical subject that necessitates hands-on activities in order to maximize knowledge acquisition from a specific concept. Negative conceptions about experimental work included teachers not incorporating enough laboratory work, teachers not ensuring that the theory part of experiments is well understood by students, students not being given opportunities to carry

out experiments on their own (or it being done by selective students only), and experimental work being infrequent.

The current study aligns with Bernado's [49] second (science inquiry activities) and third (support for self-learning and effort) dimensions of students' perceptions. According to the findings of that Filipino study, assessment practices in science did not involve enough inquiry-oriented activities and did not provide enough guidance or encouragement for self-directed and effortful learning [49]. The researchers came to this conclusion because science teachers did not challenge their students enough in higher order thinking and activities (such as laboratory work) for learning and understanding science. Similarly, Osborne and Dillon [50] recommend for introducing students, particularly those pursuing basic education or in primary grades, to scientific processes through investigative work, actual experiments, and other forms of inquiry-based activities. As a result, it is possible that only a small number of junior student participants mentioned experiments as a preferred assessment technique. They may be unfamiliar with this technique as a result of a lack of experimental work in their primary school science classes.

In contrast to the above, according to some studies, high-level students are generally satisfied with their science classes, despite the lack of more challenging activities [49, 51]. This was evident in the current study as well, with one senior student believing that the current type and frequency of assessments were adequate. However, this cannot be generalized because the participant was a high-achieving student whom the researcher knows from personal experience to be a learning-oriented student with intrinsic motivation to succeed in school.

Some senior student participants in this study suggested that students participate in assessments, such as conducting independent experiments. According to Dinsmore and Wilson [52], an older student with higher abilities may benefit more from assessment participation than a very young child due to learner characteristics such as the development of self-regulation skills. This means that senior students are better able to complete independent tasks than junior students, who may require some guidance. One of the best ways for students to learn science is to do science [12] or to participate in assessment tasks in a laboratory, where they gain hands-on experience and gain control of the learning process while their science teachers act as guides [12]. This practice is known as 'cognitive apprenticeship' in the constructivist theory of learning. Because science teachers allow hands-on inquiry-based learning in these settings, cognitive apprenticeship is evident in most high schools that emphasize experimental work in science lessons. Despite its benefits, there is skepticism in the literature, and more research is required to convince that participation in assessment does induce self-regulation. The researcher believes that students are sometimes eager to conduct experimental work not to improve their understanding, but because being in the laboratory fascinates them. One reason is that students use surface approaches to learning and are more concerned with task requirements than with conceptual understanding [51].

When a few senior student participants mentioned that tests as an assessment become a comparison to other schools' achievements, a negative feeling arose. One senior student participant, for example, stated that "the competition goes outside the school" (Student 2B). Schools maintain standards or accountability by establishing a benchmark to determine which students advance to the next level the following year. The fact that tests are used to maintain a school's standards suggests that summative assessments do have an impact on students because they are under pressure to perform well in order to ensure that their school is high achieving. Using measurement theory to justify this assessment purpose, it can be stated that assessments provide information to the local community by comparing schools to see which schools perform well in terms of student pass rate [53]. According to literature, there are several methods for maintaining standards using mathematical measurements; however, the most common method in Fijian schools is to use reference results from previous summative assessments and compare attainment between schools. The researcher discovered from the responses of the participants that students are aware of the implications of their exam results on a larger scale.

A few student participants, as mentioned in the findings, did not prefer surprise tests. According to Brown and Harris [9], surprise tests should be avoided, and tests should be designed to match students' abilities. Unpredictability and surprises, as previously mentioned, may also elicit negative emotions toward assessment, such as anxiety [44]. In the current study, students preferred to have assessments when they were prepared or shortly after a lesson was completed. This is due to the fact that the concepts taught in the lesson are still fresh in their minds. Struyven et al. [51] discovered that students found traditional assessments boring and that they did not help students retain information over time. Their study is comparable to the current study in that traditional assessments only measure memory or recall abilities, which explains why students prefer doing such assessments the day after a lesson. According to the researcher, these students viewed written tests as a means of recalling information rather than retaining it.

Although senior students preferred contemporary assessments over written tests, the latter have limitations of their own. A few student participants in the current study expressed negative attitudes toward presentations and peer-teaching. This is supported by research by Ballantyne et al. [54], who found that learners who used peer teaching disliked it because it was time consuming and evaluated them on multiple pieces of work in a single setting. Similarly, Dochy [55] discovered that students have mixed feelings about peer assessments because they don't know how to do it correctly and don't think it's fair to have low-performing students over-mark and high-performing students under-mark their classmates. In addition, some students in this study did not like quizzes and

presentations as an assessment technique because they were confusing, embarrassing, and disorganized. One student participant, for example, stated that in verbal quizzes, they "just shout answers" (Student 13A). Performance assessments include verbal quizzes and presentations, which are used to assess students' behavior in real-world situations. Embarrassing feelings during performance assessments can be reduced if the teacher creates a welcoming environment in the classroom. For example, rather than targeting students individually, which can be intimidating, the teacher can engage them in a friendly interaction. Furthermore, confusing and disorganized assessments indicate a lack of adequate training and knowledge among science teachers to conduct such assessments effectively in the classroom.

According to Bevitt's [56] research, student participants felt they wasted a lot of time preparing for presentations, because much time is spent prior to the presentation learning how to work in a group. Similarly, relevant studies accepted this concept among students because performance assessments can be confusing and students may struggle to fully understand what is expected of them to complete the task [57]. Also, performance assessments eventually go so far as to elicit negative conceptions such as feelings of pressure, anxiety, stress, and decreased motivation to learn [56]. This was fairly obvious in the current study, as some student participants expressed dissatisfaction with a specific performance assessment for the same reasons revealed in the literature. One student participant, for example, stated that "when other students are presenting, we are focused on what we will present next and don't understand or focus on what they say" (Student 19B). This was significant for the researcher, who utilizes similar assessment techniques in her classroom. According to some studies, presentations are mostly beneficial to articulate and confident students [58]. More research into improving and motivating students in performance assessments for science learning is thus recommended.

The current study revealed a few narrow, but noteworthy, student conceptions of assessment preferences. Peer-teaching, for example, was mentioned as a preferred method of assessment by senior student participants. Peer-teaching is a concept that allows a more knowledgeable individual to coach a less accomplished student, assisting them in grasping concepts through their explanation. When students are unable to comprehend what teachers are attempting to convey, they may prefer this method. According to Cowie [3], peers have an added advantage with peer-learning in that they provide timely feedback in the language that their peers understand. Some student participants in the current study expressed similar beliefs; for example, one student participant stated that "students understand better when friends explain rather than teachers" (Student 15B).

Questioning was another type of assessment mentioned by the student participants. Questioning is a type of mastery learning in which teachers correct or accept student responses after they try to answer a question. This is a traditional form of assessment that was emphasized by the Socrates Method, which had as one of its main goals instilling critical thinking in students and allowing them to clarify ambiguity on a deeper level [9]. Cowie's [3] study justified questioning as a formative process; however, students in the study claimed that in the absence of mutual respect in the classroom, they were more likely to limit their responses when probed with a question due to fears of approaching harm. Students, for example, become intimidated when they are surrounded by people they do not know or when they are questioned by a new teacher. According to the current study, science teachers and students are engaging in formative questioning and answering through dialogues. Using the socio-cultural theory, this focuses on how students learn by socializing with their teachers to the point where independent thoughts emerge [59]. This learning is a two-way process, with an emphasis on active student engagement, which is characteristic of formative assessment [59].

In the current study, a few student participants mentioned using modern assessment techniques in their science classes, such as incorporating ICT or digitalized tools. Students enjoy using technological devices, but they prefer books and paper assessments, according to Andrew, Taylorson, Langille, Grange, & Williams [60], students who mentioned using digital tools in this study focused on visual aid for better understanding of scientific concepts. It is worth noting that only a small number of participants preferred digital tools. This could be because some students take longer to understand how to use digital technology correctly [60]. Another reason could be that teachers are unwilling to use digital assessments in science lessons, or that the school lacks adequate facilities to accommodate this learning strategy. However, some studies, such as Van der Berg, Admiraal, and Pilot [61], suggest a combination of written and visual contact as a new strategy for including ICTs in learning so that students can benefit from both face-to-face assessment and the use of a virtual environment.

8. Final Considerations and Educational Implications

Most of the participants described the purpose of the assessment in a dialogical way, emphasizing the formative assessment and the importance of feedback for learning or modifying teaching strategies and adapting them to the specific needs. To promote significant learning in these students, the researcher believes it is necessary to introduce changes that make the assessment practices authentic and more formative, and consistent with their conceptions. The results indicate that the assessment practices change slowly. Therefore, it is suggested that if a more dialogical teaching and learning process is required, more specific research in real assessment contexts is needed to understand teacher assessment practices. The researcher suggests that the development of assessment

practices could be supported through more collaborative practices of assessment. Sharing positive experiences of assessment in collaborative settings may result in greater awareness of the relationship between assessment conceptions and practices [62]. Thus, if learning is socially situated, the role of teachers in analyzing and reflecting on the needs of their students requires that emphasis be placed on the formative assessment of understanding of the students. Therefore, it is important that teachers and students come to a common understanding of the meaning of communicated feedback for students to understand how to improve their performance [63]. In this sense, newer assessment practices, deriving from the socio-cultural approach, are required. The assessment task should highlight how the learning process is developing and must be understood as an interactive, dynamic, and collaborative task (with the teacher and the peer group) to develop students as self-regulated learners [63].

9. Conclusion

Although the findings of this study are justified, they need to be followed up on. More research into the relationship between students' conceptions and preference of assessment in science is needed. Having begun this study with an interest in both science teachers' and students' conceptions, it is only natural that an investigation of students' conceptions of alternative assessments be conducted. The purpose of this research was to contribute to the fields of science students' and teachers' conceptions and educational assessment. It has developed a relatively brief semi-structured interview instrument that aims to make science students' and teachers' conceptions of assessment explicit and that could be used in professional development within schools for clarification of conceptions among faculty, particularly between leaders and teachers, and the development of assessment innovations such as performance assessments. More importantly, the thesis uncovered some useful relationships between students' and teachers' conceptions of assessment. Among these discoveries are the existence of both traditional and contemporary assessment techniques.

Finally, the most important contribution of this thesis is confirmation that science students' and teachers' conceptions of assessment are complex and varied. Researchers, policymakers, teacher educators, teachers, and teacher trainees now have evidence from students' and teachers' own thinking that assessment should not be conceived in an overly simplistic manner. This thesis concludes with a positive outlook into emphasizing teachers' professional development in science using formative assessments. As Black, Harrison, Lee, Marshal, and Wiliam [64] have put this notion into words, that, although the development and implementation of formative assessment will most likely be a risky journey, it is one worth taking, not only for the benefits directly related to student learning, but also for the implicit benefits in terms of what we can learn for our future work in the area of teacher professional development.

In conclusion, this study has made a significant contribution by confirming that the assessment held by science students are diverse and intricate. The findings of this study provide valuable information for researchers, policymakers, teacher educators, teachers, and trainees, highlighting that assessment should not be viewed as a simple and straightforward concept. The study suggests that more emphasis should be placed on teachers' professional development in science, specifically with formative assessments. Overall, this research underscores the importance of understanding and addressing the complex conceptions of assessment that science students hold. The benefits of formative assessment are related not only to student learning but also to the knowledge gained for future work in teacher professional development. The study also found that science students defined assessment by giving examples of assessment techniques and listing the purposes of assessment. To enhance students' understanding of assessment, the researcher recommends using the term 'assessment' in primary and secondary school classrooms, which will enable students to provide clearer definitions of assessment and comprehend what an assessment entail.

The researchers suggest that science teachers consider the high school students' perspective on assessments, which indicated that they view assessments positively when they are fun but have mixed or negative emotions when unprepared. Therefore, it is recommended that teachers establish clear assessment criteria before conducting assessments in their classes. Additionally, negative emotions experienced during performance assessments, such as presentations, can be reduced by creating a more welcoming and supportive classroom environment where all students' opinions are valued.

According to the study findings, science students expressed a strong desire for feedback from their teachers. Therefore, it is recommended that professional development for science teachers include training on providing effective feedback to students. The students also recommended more opportunities for independent participation in laboratory work, so teachers should consider creating opportunities for students to work independently on science projects under their supervision.

Abbreviations

MoE	Ministry of Education
CAS	Curriculum Advisory Services
TEST	Technology and Employment Skills Training
FY10CE	Fiji Year 10 Certificate Examination
FY12CE	Fiji Year 12 Certificate Examination
FY13CE	Fiji Year 13 Certificate Examination

Author Contributions

Karishma Kavita Pillay is the sole author. The author read

and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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