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Characterisation of flipped classroom teaching in multigrade rural schools

Javier Castillo-López  and Daniel Domínguez Figaredo 

Department of Educational Theory and Social Pedagogy, Faculty of Education, National Distance Education University (UNED), Madrid, Spain
jcastillo184@alumno.uned.es

Multi-age classrooms are student-centred classrooms. Flipped classroom teaching promotes active learning. In the research reported on here, we analysed the characteristics of flipped classroom teaching in the context of multigrade rural schools. Two main questions were raised: whether the characteristics of rural multigrade classrooms require adapting the flipped classroom method, and whether there is a particular framework for applying this method in such classrooms. A questionnaire was administered to and interviews held with teachers who used flipped classroom in their multigrade classrooms. The data show a typology of flipped classroom strategies adapted to multigrade classrooms. It is also concluded that applying flipped classroom in multi-grade classrooms requires significant changes in the instructional design and classroom learning phase. No changes were detected during the previous phase of individual work outside the classroom. A regular framework for the application of the flipped classroom method in multigrade rural schools could not be determined due to the heterogeneity of this kind of class.

Keywords: flipped classroom; instructional design; multigrade classroom; rural schools

Introduction

Flipped classroom (FC) is a methodology that leverages the use of technology to increase the time spent in classroom practice between teachers and students. Although “flipping” traditional classrooms can take many forms, approaches that are considered standard define FC as a set of pedagogical approaches that (Abeysekera & Dawson, 2015; Arnold-Garza, 2014):

- move most of the teaching related to the transmission of information out of the classroom;
- require students to do pre- or post-class activities to get the most out of in-class work; and
- use class time for learning activities that are active and social.

The FC is generally considered an educational method that promotes student-centred, self-directed, and active learning (Awidi & Paynter, 2019). However, there are still knowledge gaps regarding the application of the method in special settings such as multigrade environments in rural classrooms, which was the focus of this study.

A multigrade rural classroom (MRC) is a primary school classroom with a small number of students where one or several teachers attend to children of different grades in the same classroom (Ronksley-Pavia, Barton & Pendergast, 2019). Multigrade classes are often created through necessity and are mainly found in rural areas, as reflected in studies in various countries in Europe (Hyry-Beihammer & Hascher, 2015; Smit, Hyry-Beihammer & Raggl, 2015), South Africa (Du Plessis & Mestry, 2019) and other African countries (Brown, 2010; Mulkeen & Higgins, 2009), Latin America (McEwan, 2008), North America (Mulryan-Kyne, 2007), and Australia (Beutel, Adie & Hudson, 2011; Cornish, 2010). As with any other methodology, the mission is to achieve the learning objectives for the educational stage proposed in the curriculum. The main feature here, however, is that the teacher relies on students in higher grades to achieve this (Echazarra & Radinger, 2019).

In order to deepen the characterisation of the FC method in MRC, a study was conducted with the double objective of analysing the teaching practices associated with the FC method, and additionally providing an explanatory framework about its application in those specific spaces. The study was contextualised in a region of North-eastern Spain with a high demographic dispersion and where there are many rural schools. We initially review the literature on the connections between the FC method and MRC, followed by a description of the research design and discussion of the results.

Literature Review

Multigrade rural classrooms challenges

Multigrade classrooms are classes in which students from two or more grade (year) levels are taught by one teacher who is responsible for all the children in that class. In addition, as is the case in this research, multigrade classrooms may be found in rural areas where enrolment rates are low and, therefore, economic justifications do not support the employment of one teacher for each year level (Proehl, Douglas, Elias, Johnson & Westsmith, 2013).

Students in multigrade classes typically maintain their grade label, with grade-level textbooks and curriculum (Mulryan-Kyne, 2007). Teachers are required to teach different subjects and grades in one class (Du Plessis & Mestry, 2019). The multi-age experience provides positive elements for student learning and socialisation. Boyd (2020) and Canter (2017) compiled some of the potential benefits from a pedagogical standpoint:

- The loop allows students to be with the same teacher for more than 1 year, thus enabling them to build stronger relationships with each other.
- In the multi-age classroom, diversity in developmental level is valued by the community of learners. Teachers can differentiate the grouping and difficulty of the tasks students perform. In addition, students can work on the same topic at their own pace.
- The multi-age environment can also benefit social skills and behaviours. In multi-age classrooms, the emphasis is on learning with others, taking part in mutual learning (Ngwenya, 2019).

However, introducing the “rural” factor in multigrade environments leads to some negative effects. Students from rural schools tend to have lower academic performance and their promotion rate to higher studies is lower than that of urban students (Echazarra & Radinger, 2019; Organisation for Economic Co-operation and Development [OECD], 2016). Differences tend to disappear once socioeconomic status is taken into account, but rural students are less likely to complete a university degree than urban students, expectations that persist even when rural students have similar socioeconomic status to urban students (OECD, 2016).

Evidence points to the importance of raising aspirations and creating opportunities for rural students. According to the OECD, FC is among the successful experiences that can help bridge that expectation gap and ensure high-quality teaching for students in rural contexts (OECD, 2017).

Flipped classroom in multigrade classrooms

Practices related to flipping the conventional instructional method have grown in popularity in recent times and are now a common resource at all levels of the educational system. Specific studies on the subject are still scarce, but the coupling of existing research with learning sciences, cognitive education and classroom case studies is showing how flipping practices help to enrich classroom activity and enhance learning (Kim, Kim, Khera & Getman, 2014; Song, Y & Kapur, 2017). It has also been found that FC practices can increase student motivation in different content areas (Bond, 2020), and it allows educators to pay attention to those with different skills (Lo & Hew, 2017; Munir, Baroutian, Young & Carter, 2018; Walker, Tan & Koh, 2020).

FC is a learning methodology that requires the use of higher-order cognitive functions from students, which are more cognitively demanding than those addressed by traditional, more passive teaching formats. The active learning (application, problem-solving) and social learning (discussion) activities of FC classes are usually arranged in the in-class phase. These in-class activities are often interdependent and arranged in complex scenarios and are likely to impose a heavy information

processing load on students (Abeysekera & Dawson, 2015).

Multi-age classrooms are very student-centred (Song, R, Spradlin & Plucker, 2009). By applying multi-age approaches in classrooms and implementing differentiated teaching strategies to meet the needs of all learners, a student-centred, project-based learning environment is more likely to be established, as learners at different levels may pay more attention to individual projects, which are carefully designed to test their own knowledge and abilities, in contrast to a common curriculum, which does not specifically focus on individual abilities (Aina, 2001).

Applying FC in multigrade classes depends heavily on the teacher’s preparation in these two specific domains. One of the main challenges in determining the quality of flipped sessions is teachers’ preparation and involvement. Research indicates that FC requires redesigning instructional planning (Howitt & Pegrum, 2015). It also demands greater time commitment on the part of the teacher. Aspects such as pre-recording or selecting the videos that replace direct classroom instruction, such as designing appropriate accompanying questions and other out-of-class activities, requires more time (Akçayır & Akçayır, 2018).

In the same vein, many of the professional skills for teaching effectively in single-grade contexts need greater emphasis preparing teachers for multigrade teaching. Research has shown that it is the quality of teaching, rather than the grade configuration or class composition that is the most important determinant of the quality of student learning in MRC (Mulryan-Kyne, 2007).

Methodology

With this study we focused on the application of the FC method in the context of MRC. The research was guided by two research questions:

- Research question 1 (RQ-1): Does the implementation of the FC method in MRC require adapting standard FC procedures?
- Research question 2 (RQ-2): Is there a particular methodological framework for applying FC in MRC?

RQ-1, related to the first objective of the research, is based on the analysis of FC teaching practices in MRC. The aim was to determine whether interventions with students of different levels affected the sequence and habitual actions in FC. RQ-2, related to the second objective, was to determine some kind of regularity or pattern in the eventual variation in the application of the FC method in these types of spaces.

In order to answer these questions, questionnaire-based research was conducted, complemented by in-depth interviews with teachers in rural multigrade classrooms. The data collected came from teachers in a number of schools located

in a specific region, allowing the research to be formulated as a case study.

Data Collection

Two instruments were used to answer the RQs:

- 1) Questionnaire. An online questionnaire was designed and sent to teachers in rural multigrade

schools. The items were open-ended in order to allow teachers to provide details of their application of the FC method. The structure of the questionnaire was based on the functional scheme of the FC. The information obtained in the questionnaire was the main source for answering RQ1. Table 1 shows the dimensions of the items of the questionnaire.

Table 1 Dimensions of the questionnaire

Dimensions	Sub-dimensions
Instructional design	Multigrade curriculum plan Parallel curriculum plan Learning content Methodology of the individual learning stage Methodology of the collective learning stage
Individual learning stage – pre-class activity	Preparation Learning activities Learning resources Learning assessment Timing Difficulties
Collective learning stage – in-class activity	Learning recovery Learning activities Organisation Learning assessment

- 2) In-depth interviews. After analysing the data obtained from the questionnaires, telephone interviews were conducted with all the teachers in the sample. The purpose was to obtain evidence to answer RQ2. The interviews made it possible to complete the available information based on the same outline as the questionnaire. The extracted information was processed with content analysis software.

Participants and Context

The research is considered a case study focused on the Spanish region with a high population

dispersion. To select the research sample, the official database of the region was searched for teachers who met the following two criteria:

- 1) A teacher in a rural multigrade school within the regional education system.
- 2) Completed a training programme on the FC method offered by the regional education administration.

The final sample consisted of 15 teachers in the region who applied the FC method in MRC in different learning situations and conditions. Table 2 shows the particular contexts of the classrooms analysed.

Table 2 Context of the participants

Teacher	Students in classroom (grades)	Students in FC method (grades*)	Students' level in the "learning to learn" competency	Students' level in the "digital" competency
1	5 (5)	1 (K-6)	Sufficient	Sufficient
2	6 (3)	6 (K-4, K-5, K-6)	Sufficient	Sufficient
3	7 (3)	7 (K-4, K-5, K-6)	Sufficient	Insufficient
4	6 (4)	6 (K-2, K-3, K-4, K-6)	Sufficient	Sufficient
5	10 (7)	6 (K-1, K-2, K-3, K-5, K-6, K-7)	Diverse	Diverse
6	12 (4)	6 (K-4, K-6)	Diverse	Diverse
7	20** (6)	20 (K-1, K-2, K-3, K-4, K-5, K-6)	Sufficient	Diverse
8	13 (4)	13 (K-3, K-4)	Insufficient	Insufficient
9	7 (5)	7 (K-1, K-3, K-4, K-5, K-6)	Diverse	Sufficient
10	11 (3)	11 (PK-3, PK-4, K)	Sufficient	Diverse
11	10 (4)	10 (PK-3, PK-4, K, K-1)	Diverse	Diverse
12	9 (4)	9 (K-3, K-4, K-5, K-6)	Diverse	Diverse
13	4 (4)	4 (K, K-3, K-4, K-5)	Insufficient	Sufficient
14	10 (2)	10 (K-1, K-2)	Insufficient	Diverse
15	19 (3)	18 (K-4, K-5, K-6)	Diverse	Diverse

Note. *K-12 system, where K = kindergarten, and PK = pre-kindergarten. **Two classes working together.

The number of students in each classroom varied according to the cases, with a minimum of four and a maximum of 20 students. Not all students in the classroom participated in the FC method; in some cases only one student was involved and in others the methodology was applied to the entire class (11 experiences). As for the number of grades taught, it varied between one and six courses in the same classroom. As for the students' profiles, diagnostic tests were conducted at the beginning of the course to determine the students' initial level in the key competencies established in the Spanish educational system, resulting in a diversity of levels in the "learning to learn" and "digital" competencies, which are those closely related to the FC method.

Results

The results below are presented according to the two RQs. To improve the interpretation of the results, the analysis combines survey and interview data.

Instructional Design

Table 3 contains the information related to the instructional design dimension. Teachers take into account the diversity of educational levels of students when designing learning experiences in multigrade classrooms. They take this information as a reference to propose learning strategies that integrate the whole group, and with adaptations to the particular situations of students who require differential treatment. This is considered a multigrade curriculum plan (MCP).

In the research, all but one of the teachers surveyed (14 of 15) were applying the FC method in their multigrade classes, and integrated the methodology within the framework of an MCP. However, we found differences in the way in which the multigrade student groups were integrated.

All learning content were managed from two approaches: focusing on a thematic unit within an area (10 cases), and designing the sessions based on interdisciplinary projects that address a variety of topics together (four cases).

All the experiences combined a pre-class individual learning phase and an in-class collective learning phase. In the pre-class phase, it was common to use learning methods based on direct instruction, with video content or other resources that students had to watch/consult. In 10 cases direct instruction was the exclusive method, and in five cases it was combined with other learning strategies oriented to discovery and research.

Likewise, in the collective learning phase in multigrade classes, all the cases presented two differentiated stages:

- Firstly, a recovery period, in which students reviewed the work that they had done previously (generally as a group);

- Secondly, a period in which students delved deeper into the topics through activities that allowed them to develop and apply what they had learned.

The methodological approaches in these two stages were diverse: in the recovery phase it was common for the teacher to be proactive and have direct control of the situation (11 cases vs. four), which refers to passive learning strategies. In the deepening phase, which was the richest in terms of learning development, active learning practices were proposed in all cases (15 cases) that promoted self-directed learning. Finally, in almost all cases (14 cases) the diversity of the student levels was applied positively through peer learning. Students at higher levels were involved in the activities by guiding the rest of the students.

Table 3 Instructional design

Teacher	MCP*	PCP**	Content management	Individual stage methodology	Collective stage methodology	
					Recovery	Deepening
1	No	Yes	Thematic unit	Direct instruction	Passive	Active
2	Yes	No	Thematic unit	Direct instruction	Active	Active Peer learning
3	Yes	No	Thematic unit	Direct instruction	Passive	Active Peer learning
4	Yes	Yes	Thematic unit	Direct instruction	Active	Active Peer learning
5	Yes	Yes	Various themes	Direct instruction	Passive	Active Peer learning
6	Yes	Yes	Thematic unit	Direct instruction	Passive	Active Peer learning
7	Yes	No	Thematic unit	Direct instruction	Passive	Active Peer learning
8	Yes	No	Thematic unit	Direct instruction	Passive	Passive Peer learning
9	Yes	No	Thematic unit	Direct instruction	Passive	Active Peer learning
10	Yes	No	Various themes	Direct instruction Discovery	Active	Active Peer learning
11	Yes	No	Various themes	Direct instruction Discovery	Passive	Active Peer learning
12	Yes	No	Thematic unit	Direct instruction Discovery	Passive	Active Peer learning
13	Yes	No	Various themes	Direct instruction	Passive	Active Peer learning
14	Yes	No	Thematic unit	Direct instruction Discovery	Passive	Active Peer learning
15	Yes	Yes	Isolated tasks	Direct instruction Discovery	Active	Active Peer learning

Note. *Multigrade curriculum plan (MCP). **Parallel curriculum plan (PCP).

Individual Learning Stage – Pre-class Activity

All respondents referred to an individual learning phase outside the classroom prior to the in-class session, in which students accessed resources and activities specially prepared by the teacher as part of the learning process in the FC method. Table 4 shows the teachers' responses to this stage.

Most of the teachers (12) scheduled a prior training period in the classroom to learn the new approach and guidelines to successfully perform the tasks.

As for the learning activities, most of them focused on watching videos (14) and completing forms (nine) related to that content. Some teachers

occasionally proposed other varied activities such as summaries, research activities, et cetera.

In the development of the learning resources used in this phase, all teachers reported having edited the videos that they provided to students. Depending on the circumstances, sometimes existing videos were used to which questions or additional elements, designed by teachers, were added.

In this phase, all cases incorporated some type of formative assessment. The aim was to know the learning evolution, providing personalised feedback and adapting the lesson plan according to the needs of each student.

The timing of the activities ranged from half a week (six cases) to 1 school week (five cases). In some cases variable timing was reported depending

on the planning of each subject.

Finally, the section on difficulties encountered is especially interesting due to the condition of rural multigrade classrooms. In all the experiences described, various problems hindered the correct functioning of the activities. In 11 experiences some students did not deliver the proposed activities in full. The next most frequent difficulty was technological problems (defined as “Tech issues” in Table 4) related to a lack of devices and poor connectivity (10 cases). Less frequently, difficulties were also reported on mismatches in the teachers’ design of the experience (four cases), and others due to a lack of students’ skills in one of the two competencies involved, “digital” and “learning to learn” (four cases).

Table 4 Individual learning stage – pre-class activity

Teacher	Pre-training	Learning activity	Learning resources	Learning assessment	Timing (days)	Difficulties
1	Yes	Video viewing Summary Quiz	Video editing Quiz design Task design	Formative	2–5	Student ability Learning design
2	No	Video viewing Physical exercise	Video editing Task design	Formative	2–5	Not submitted Tech issues
3	Yes	Video viewing Quiz	Video editing Quiz design	Formative	5	Not submitted Tech issues
4	Yes	Video viewing Quiz	Video editing Quiz design	Formative Summative	5	Tech issues Student ability Learning design
5	Yes	Video viewing Summary Quiz	Video editing Quiz design Task design	Formative	2–5	Not submitted Tech issues
6	No	Video/text/viewing/reading Quiz	Video editing Quiz design	Formative	5	Student ability Tech issues
7	Yes	Video viewing Quiz	Video editing Quiz design	Formative	–	Not submitted Learning design
8	Yes	Video viewing Quiz	Video editing Quiz design	Formative	2–5	Not submitted Tech issues
9	Yes	Video viewing	Video editing	Formative	–	Not submitted Tech issues
10	Yes	Research Creative activity Tech activity	Task design Task design	Formative Summative	10	Student ability Not submitted
11	No	Video viewing Quiz Research	Video editing Quiz design Task design	Formative	2–5	Not submitted
12	Yes	Video viewing	Video editing	Formative	5	Learning design
13	Yes	Video/text viewing/reading Summary	Video editing Task design	Formative	5	Not submitted Tech issues
14	Yes	Video viewing Quiz Recording activity	Video editing Quiz design Task design	Formative	2–5	Not submitted Tech issues
15	Yes	Video/text viewing/reading Miscellaneous	Video editing Task design	Formative	–	Not submitted Tech issues

Collective Learning Stage – In-class Activity

Table 5 summarizes the in-class activity. In all cases the classroom learning phase started with activities to link the activities to prior learning. The main method used was a group presentation of what was learned in the previous phase. The teachers explained that in multigrade classes this system favoured the vertical circulation of ideas among various levels and with different comprehension abilities.

As shown in Table 4, some students did not prepare adequately during the previous phase. To correct these situations, different alternatives were proposed. The most common was to work in class on compensatory activities based on the activities of the out-of-class phase. When access to video learning resources was considered, explanations by other students or the teacher were added.

In terms of organisation, 14 of the experiences promoted group activities. In 12 of them, these groupings were multigrade activities at some point. Likewise, there were four groupings of students in the same grade, although both approaches were combined in several occasions. In one case the students' level of proficiency was always taken into account without specifically sticking to the grade to which the students belonged. In most cases flexible time schedules were used (10 cases), in some cases even altering the official timetable.

The requirement to adapt learning activities to multigrade classes – with the possibility of

exchanging knowledge among students of different grades, ages and levels – led to three possible approaches: individual, group and collaborative activities. Individual activities (14 cases), mainly support activities, could focus on specific content associated with each level or be common to the whole class, but carried out individually. In the group activities (14 cases), a common objective was assigned to a multilevel group of students and the process was monitored by the teacher. Finally, collaborative activities (10 cases) refer to those tasks that serve to differentiate personal objectives within a group activity. All students contributed to the common objective, each one from their own position (grade, competence or out-of-class phase preparation).

Finally, in 13 cases a mixed evaluation was applied, with the dual purpose of analysing how the process was developing and providing the necessary feedback to the students (formative evaluation), and also to verify the level of learning achieved at the end of the process (summative evaluation). Students were involved in the evaluation in five cases. In all of them, peer evaluation was chosen (co-evaluation). At the same time, in four of these, student self-evaluation was also promoted. In 10 cases the teacher was the responsible agent (hetero-evaluation). In general terms, the tools used to obtain more complete information were observation, questionnaires and documentary analysis.

Table 5 Collective learning stage – in-class activity

Teacher	Learning recovery	Organisation	Learning activity	Learning assessment
1	Yes	Single student Limited timing	Individual	Mixed Hetero-evaluation
2	Yes	Multigrade Limited timing	Individual Group	Mixed Hetero-evaluation
3	Yes	Grade/Multigrade Flexible timing	Individual Group	Mixed Hetero-evaluation Auto-evaluation Co-evaluation
4	Yes	Multigrade Limited timing	Individual Group	Mixed Hetero-evaluation
5	Yes	Multigrade Limited timing	Individual Collaborative Group	Mixed Hetero-evaluation
6	Yes	Students' academic level Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation
7	Yes	Multigrade Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation Co-evaluation
8	Yes	Grade/Multigrade Flexible/limited timing (bounded class scheme with flexible timing)	Individual Group Collaborative	Mixed Hetero-evaluation
9	Yes	Multigrade Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation
10	Yes	Grade Limited timing	Individual Group Collaborative	Mixed Hetero-evaluation
11	Yes	Multigrade Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation
12	Yes	Multigrade Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation Auto-evaluation Co-evaluation
13	Yes	Multigrade Flexible timing	Individual Group Collaborative	Mixed Hetero-evaluation Auto-evaluation Co-evaluation
14	Yes	Multigrade couples Flexible timing	Group Collaborative	Formative Hetero-evaluation Auto-evaluation Co-evaluation
15	Yes	Grade/Multigrade Flexible timing	Individual Group	Formative Hetero-evaluation Auto-evaluation Co-evaluation

Features of the FC Method in Multigrade Classrooms

In order to understand the features of the FC method specific to multigrade classrooms, aggregate data regarding teachers' practices were taken into account. In general, the analysis of the information from the questionnaire and the interviews shows that all the specificities occurred in the in-class phase, as well as in the instructional

design when the teacher had to plan how he/she would develop the educational intervention. During the previous phase of individual work outside the classroom, the dynamics did not present any distinctive elements that could be associated with the requirements of multigrade teaching.

Table 6 shows the most significant elements associated with multigrade situations in the dimensions analysed in the research.

Table 6 Impact of the multigrade context on FC elements

Features	% of total cases
Instructional design:	
1) Multigrade curriculum plan: same thematic unit approached from different levels.	93%
In-class organisation:	
2) Divided the classroom phase into two sub-phases: recovery and deepening.	100%
3) Multigrade groupings.	80%*
In-class learning activities:	
4) Group activities.	100%*
5) Collaborative activities.	71%*
In-class methodology:	
6) Peer to peer learning.	100%*

Note. *In the features related to groupings, the % is calculated on a total of 14 cases. One case in the sample had only one student in the class, consequently it was not counted.

In the instructional design section, the most outstanding feature was attention to the specific aspects of multigrade classes. Most teachers (93%) indicated that they had to adapt the elements of the curriculum to a situation in which students had different levels of knowledge and background on the topics. This transversally affected all the elements of the curriculum planning – content, methodology, resources, activities and evaluation – although each of them could be managed in a particular way according to the specific circumstances of the students in each case.

Two features stood out in the educational organisation. Firstly, the division of class sessions into two sub-phases, namely, recovery and deepening (100%). Fragmenting the sessions in this way allowed teachers to start the class attending to the specificities of each student on the basis of what each had learned in the previous phase, and then used the educational potential of group work to develop this learning in practice. The second outstanding feature at the organisational level was the proposal of a class scheme based on multigrade criteria (80%), which means that groups were arranged with students from various levels.

The learning activities in the multigrade classrooms were all developed in groups (100%) and in the majority of cases (71%) as collaborative learning. Therefore, activities were proposed to be developed as a group and with each student contributing according to his or her level. Finally, the most outstanding methodological characteristic was peer learning (100%), which seemed to be related to the ability of students of different levels to positively influence each other's learning.

Discussion

In this research we focused on the use of the FC method in MRC, based on data provided by teachers teaching in such educational settings. A common feature of research on multi-grade classes was the absence of consistent data sources reporting on the location of classes, which was generally due to the low implementation of multi-

age methodologies in most countries. The lack of consistent data to access meaningful samples hinders representative research. This barrier was evident in early reports from international agencies (Asia and the Pacific Programme of Educational Innovation for Development, 1989; OECD, 1993) and it was recurrent in recent studies from a variety of countries (United Nations Educational, Scientific and Cultural Organization, 2015). In specific reference to MRC, the subject of this research, the latest internationally available data indicates that this type of centre is a minority within the educational systems of the world (Ares Abalde, 2014; Echazarra & Radinger, 2019). Furthermore, the typology of each MRC is highly context-dependent (Mulkeen & Higgins, 2009).

The circumstances surrounding MRC, particularly the small number of ongoing educational experiences applying this model, also influenced this study. One direct impact was the difficulty of accessing direct data sources and obtaining a representative volume of information. To overcome this limitation, the research was designed as a case study, since this is an approach that allows for an in-depth analysis of the phenomena and the agents involved (Stake, 2005). A multiple case study was conducted that included a significant number of rural schools in a particular region in which teachers were applying the FC method in multi-age classrooms. This ensured that the sample was fully representative of the region where the case study was contextualised. In addition, and despite the limitations of the sample, designing the research as a case study allowed conclusions to serve as a basis for future studies on the subject, creating an adequate framework for further validation.

The data needed to answer the RQs were obtained through a questionnaire. Its structure corresponded to the phases of FC, and the items asked about teachers' practices when applying this methodology in their classes. The questionnaire is a frequent resource in descriptive research on FC (Goedhart, Blignaut-van Westrhenen, Moser &

Zweekhorst, 2019; Murillo-Zamorano, Sánchez & Godoy-Caballero, 2019), and also in studies that delve into the learning experiences of multigrade classes (Casserly & Padden, 2018; Checchi & De Paola, 2018). Thence, in our discussion we focus more on the type of instrument and its design.

Our questionnaire could have been designed from a predetermined FC scheme (Bergmann & Sams, 2012; Flipped Learning Network [FLN], 2014), but instead, existing theoretical models in the scientific literature were taken into consideration and adapted to adequately respond to the particular situations of the case studies in the sample. This was intended to avoid leaks of relevant information, which could have been left out if the rigidity of an “ideal model” of FC had been chosen – for example, on the topics of instructional design, PCP, learning assessment, et cetera. – especially considering the particularities of teaching in rural schools (Eppley, 2015; Leuven & Rønning, 2016; Quail & Smyth, 2014).

Gathering complete and rich information about teachers’ day-to-day practices through a survey also required the inclusion of open-ended questions. Viewed from formal information analysis, open-ended questions make it difficult to precisely delimit the phenomena under investigation and to create descriptive categories about them. However, in the research design, preference was given to the ability of open-ended questions to offer teachers a freer, richer and more complete explanatory tool. In many studies in the scientific literature a similar logic was applied, as for example the case of the analysis of rural schools in South Africa by Du Plessis and Mestry (2019:S3) who used the semi-structured interview to a small cohort of teachers to collect data, arguing that this approach “allows for in-depth investigation and free participant responses.”

In addition, opening up the data collection process by including open-ended questions was consistent with the way of interpreting the FC method in this research, since we intentionally avoided resorting to preconfigured schemes, opting instead to use a flexible scheme. Likewise, less standardised data collection tools offer greater capacity for analysis in cases of complex situations and with a multitude of variables involved, as is typical in educational settings.

A final derivative of the use of open-ended questions has to do with the analysis of the data collected, and the risks to the reliability and validity of the findings. To prevent this, we followed Maxwell’s (1996) recommendation to invite informants to review the data. Therefore, teachers were asked to review the information collected and provide their insights based on our analysis of the data.

Regarding the outputs, one of the usual contributions of this type of research is theoretical frameworks. The results of this research reflect the prevalence of certain teaching practices associated with FC in multigrade schools, which may point to the existence of a consistent framework. The design of theoretical frameworks is usually based on the examination of concepts and the deepening of phenomena (Meyer & Land, 2005). It can also be done from scientific literature review and research on a phenomenon over a given period of time (Smith, Hayes & Shea, 2017). However, we opted for a more empirical approach, which takes the aggregation of experiences reported by teachers as a reference. Thus, the sequence of elaboration of a conceptual framework was followed (Jabareen, 2009; Parkinson, Eatough, Holmes, Stapley & Midgley, 2016), but taking as a reference the prevalence of each element in the context of teachers’ practices, in the way that practical and applied frameworks are designed (Council of Europe, 2020).

Ultimately, attending to teachers’ practices is crucial both to improve teaching practice in multi-age environments (Hyry-Beihammer & Hascher, 2015) and to address the identified gap in initial teacher education in these settings (Little, 2006). Mulryan-Kyne’s (2005, 2007) offers some reassurance in her observation that successful learning is likely to depend more on the quality of instructional practices than on mere organisational strategies.

Conclusion

FC is a versatile methodology that can be applied in a variety of learning contexts. Multigrade schools in rural settings have some specific characteristics that require teachers to make adaptations in instructional design. In this study we analysed the connection between these two domains focusing on the practices of a group of rural multigrade school teachers who implemented FC in their classrooms.

The analysis of the results provides a series of evidence grouped around the two RQs:

- Firstly, in response to RQ-1 on the adaptations required by the implementation of FC in rural multigrade schools, the conclusion is that two of the dimensions analysed were affected:

In the instructional design dimension, a specific design adapted to the situations involved in having a variety of levels in the classroom was required.

In the in-class phase, the dimensions of classroom organisation – with the introduction of an initial recovery phase and a deepening phase, as well as the grouping of students in multigrade groups – proposed learning activities – where group and collaborative activities predominated – and

methodology – applying peer learning – were affected.

- Regarding RQ-2 on the possible determination of a framework for applying FC in MRC, the data from the study are not conclusive. The scope of the methodology used in this study does not allow validating the scheme that resulted from grouping the FC dimensions affected by the context of multigrade classrooms (cf. Table 6). Thus, it could be taken as a basis for validation in further research.
- Overall, the findings of this study show significant variations in the way in which FC is applied in multigrade schools. Thus, new lines of research are opened, both in the field of flipped methodologies and in teaching and learning practices in multigrade classrooms. And, ultimately, these findings raise new questions about the instructional capacity and overall appropriateness of the FC method to the characteristics of multigrade classrooms. While progress is being made on these open questions, the experiences of the teachers in the sample can be taken as a reference for applying FC in similar contexts.

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Authors' Contributions

JCL: Data from the thesis, data collection, improvement of drafts and finalisation of the article. DDF: study leader, conceptualisation of the article and writing of the first and improved drafts.

Notes

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