

Interdepartmental working group
for the development of scientific and technologic culture



scienza e tecnologia

**Laboratories and equipped
spaces for scientific instruction**

National survey in schools of all levels and types

Linda Giannini e Carlo Nati

Berlin –2008/10/23 -26

INVOLVED OFFICES

- **The Ministry of University and of Scientific and Technological Research**
- **The Ministry of Education**
- **The Ministry for Reforms and Innovation in Civil Service**
- **The Ministry of Cultural Heritage and Activities**

GROUP TASKS

To define actions and structures for the dissemination of scientific and technological culture throughout the Country.

To outline the course of action for a development policy that identifies the tasks of public and private bodies.

To identify and put forward projects and systemic actions aimed at schools, adults, and society in its entirety

The working group identified three key-hypotheses

Laboratory-based instruction is a critical factor in Science education.

Teacher grounding is another critical factor.

The two factors are intertwined and cannot do without each other.

THE SURVEY ON SCIENTIFIC LABORATORIES

School form: sent to all the school institutes to collect some structural data.

Teacher form: sent to a geographically organized sample of schools; middle schools were clustered for similarity.

SUMMARY OF RESULTS

1

The survey supports the working group's hypotheses:

Laboratory-based instruction is only marginally and weakly present in Science education at all school levels;

This is typically true also in senior high schools specializing in science education.

SUMMARY OF RESULTS

2

Lack of facilities does not alone explain the marginality of experimental practices; other factors are:

- logistic and organizational obstacles
- teacher grounding

SUMMARY OF RESULTS

3

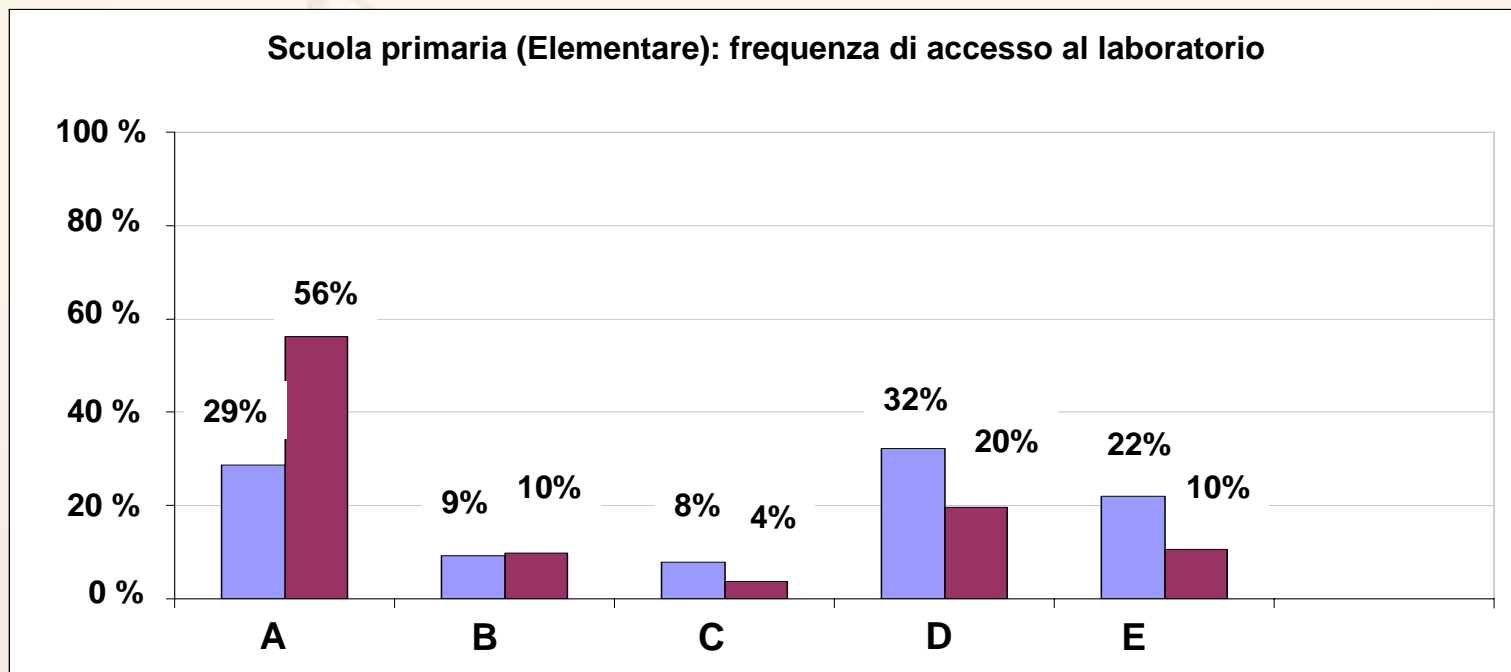
All quality factors vary across the Country and systematically replicate the well-known decreasing trend from the North to the Centre, the South, the Islands.

USAGE OF LABORATORIES

4

Less than half the teacher significantly used the laboratories and the other facilities available for scientific subjects.

This is true for all school levels, including in senior high schools specializing in science education.



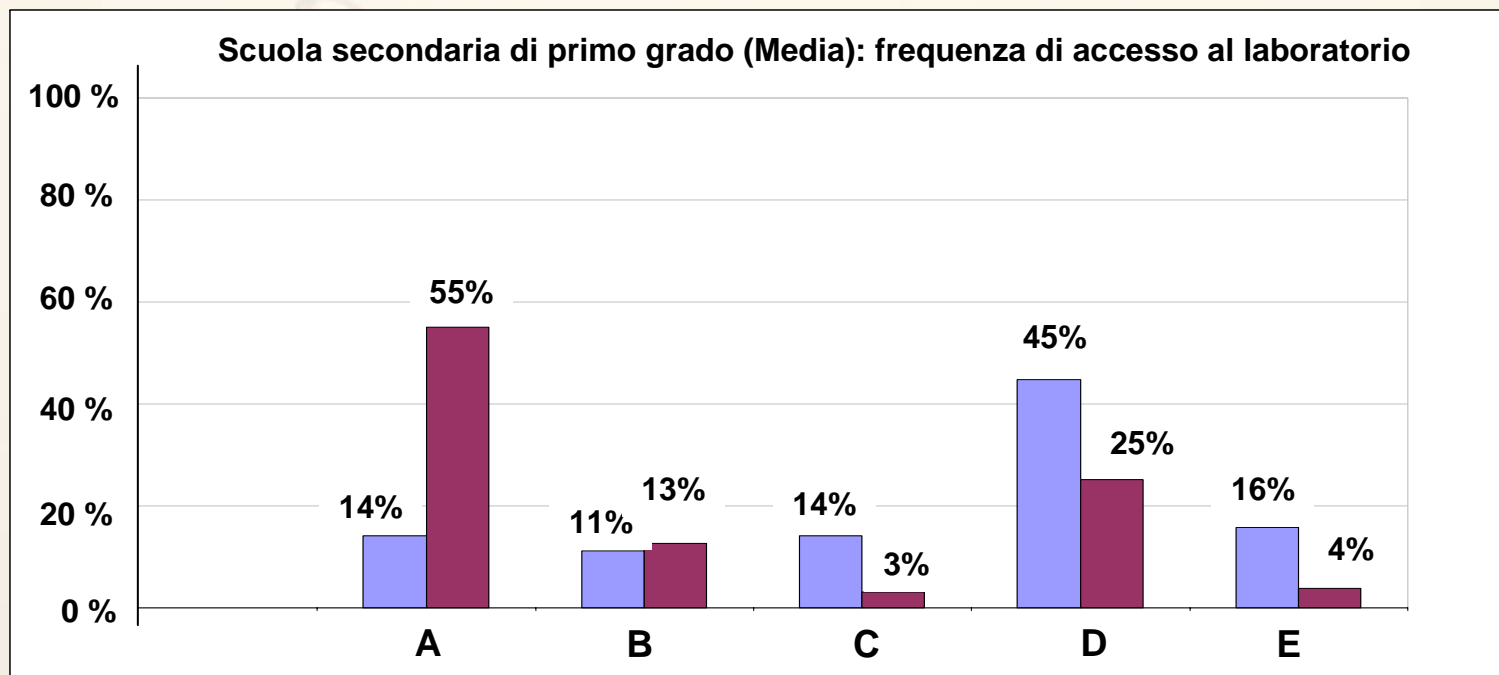
■ Scienze ■ Tecnologia

A	Almeno una volta alla settimana
B	Almeno due volte al mese
C	Almeno una volta al mese
D	Di tanto in tanto
E	Mai

Scienza è Cultura



How frequently do you use, on the average, the laboratory with each of your classes?



■ Scienze ■ Tecnologia

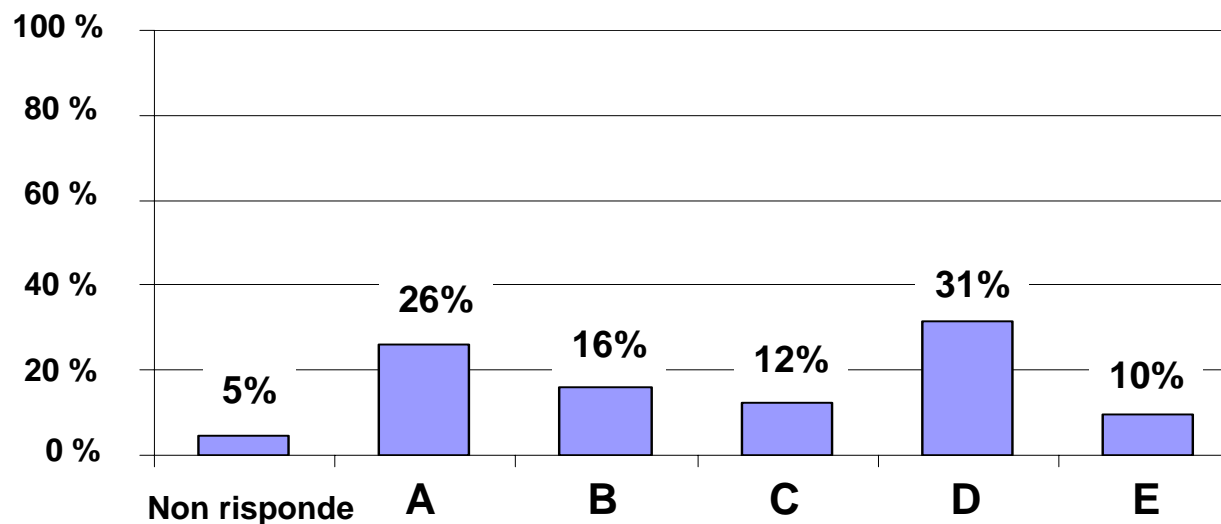
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Scienza è Cultura



How frequently do you use, on the average, the laboratory with each of your classes?

Scuola secondaria di secondo grado: frequenza di accesso al laboratorio



A	Almeno una volta alla settimana
B	Almeno due volte al mese
C	Almeno una volta al mese
D	Di tanto in tanto
E	Mai

Scienza è Cultura



How frequently do you use, on the average, the laboratory with each of your classes?

USAGE OF LABORATORIES

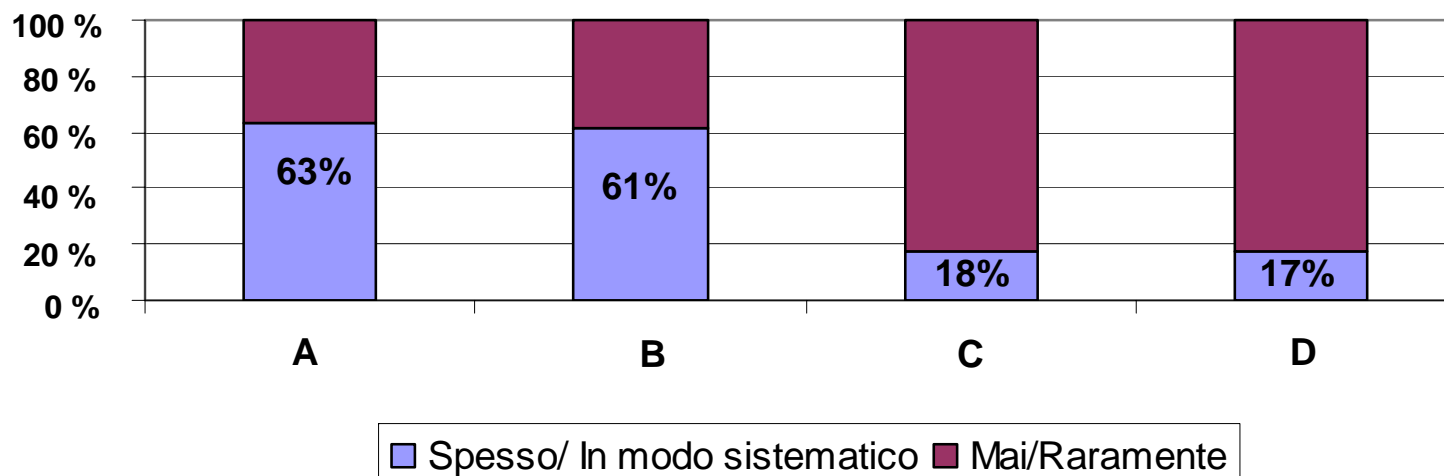
Experimental activities are seldom supported by a well-defined research methodology.

Experiments are mostly “shown” from the teacher’s desk, or “shown” and “repeated” by students; experimental activities are seldom linked in systematic way to elements in the syllabus.

K12 activities are mostly disconnected from specific subjects; in middle schools experiments only address some subjects.

There is a trend, in at least half of the cases, not to specifically assess experimental activities; this further confirms the poor relevance attributed to them.

Scuola secondaria di secondo grado: impostazione delle attività sperimentali



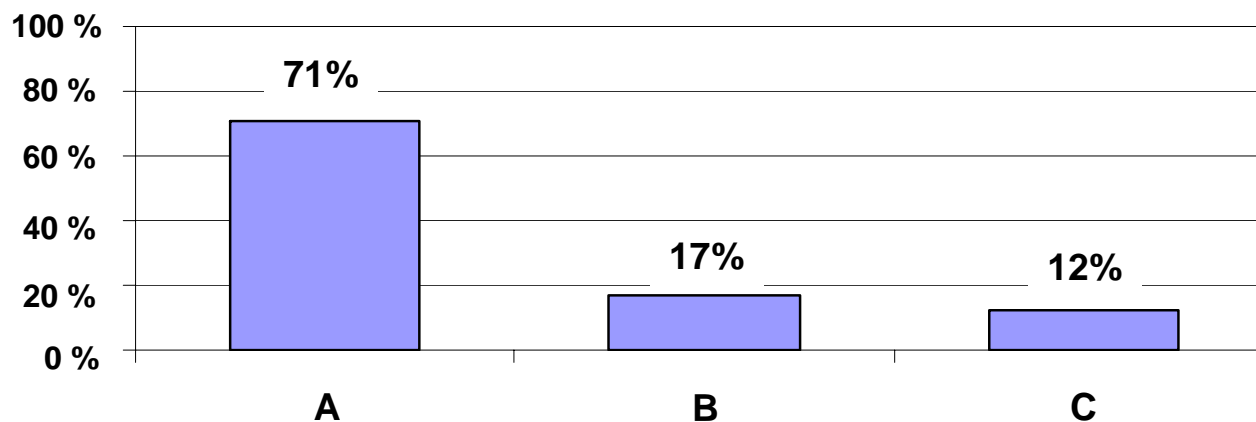
A	L'insegnante presenta un esperimento, spiega come va eseguito e poi osserva gli studenti che lo eseguono
B	L'insegnante esegue l'esperimento e dialoga con gli studenti
C	L'insegnante presenta un problema e lascia che gli studenti decidano come organizzare l'esperimento e li osserva mentre lo eseguono
D	Non vengono eseguiti veri e propri esperimenti, ma vengono assegnati problemi di una certa complessita' che durano un certo tempo e richiedono attivita' di vario genere: studio, raccolta dati, misure, esperimenti, ecc..

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How are experimental activities predominantly planned?

Scuola primaria (Elementare): rapporto tra attività sperimentali e contenuti disciplinari



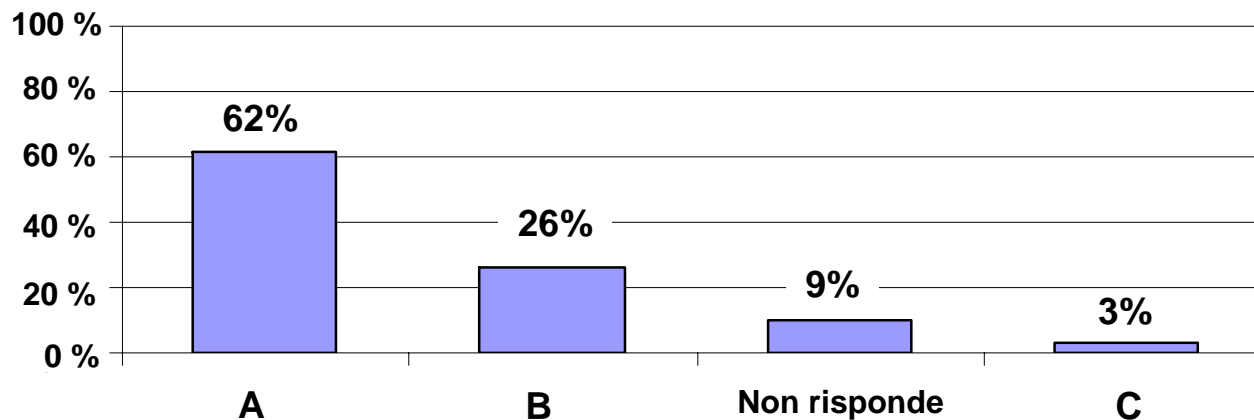
A	Sono svincolate dai singoli temi, sono dedicate a percorsi multitematici
B	Vengono realizzate solo per alcuni temi; l'attività sperimentale non è funzionale alla didattica
C	Vengono realizzate per tutti o per gran parte dei temi; l'attività sperimentale è funzionale alla didattica

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How are experimental activities linked to subject elements?

Scuola secondaria di secondo grado: rapporto tra attività sperimentali e contenuti disciplinari



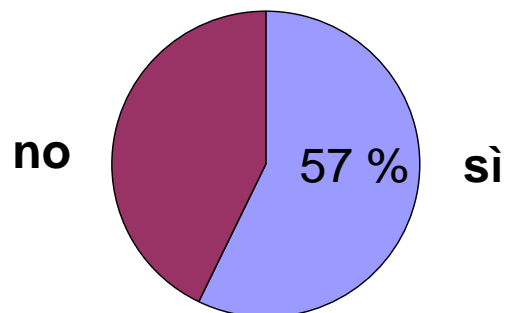
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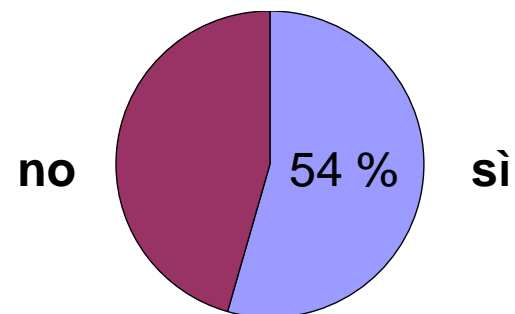


How are experimental activities linked to subject elements?

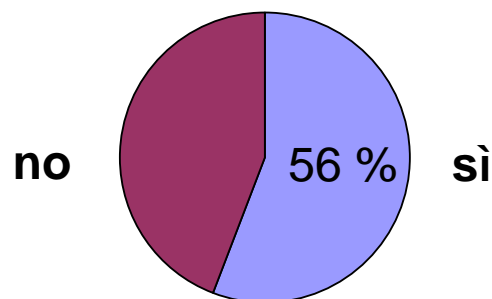
Scuola primaria



Scuola secondaria di primo grado



Scuola secondaria di secondo grado

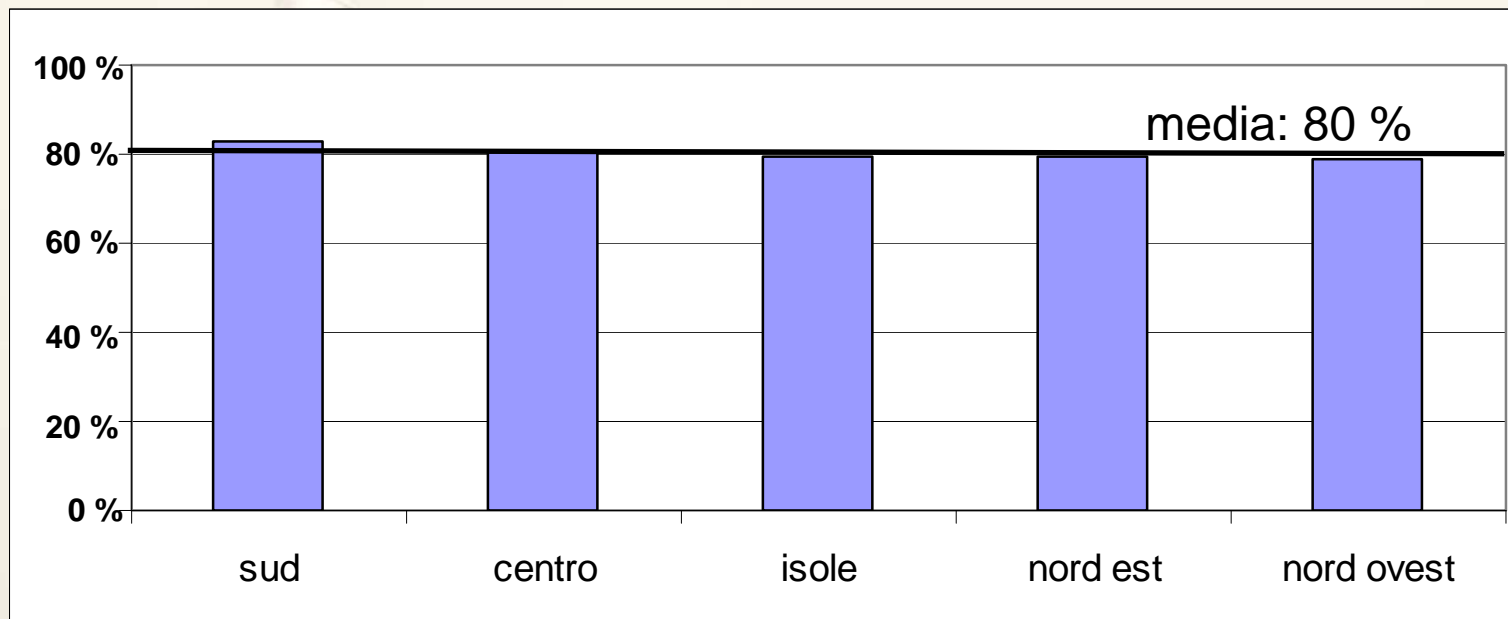


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In your teaching do you specifically assess experimental activities?

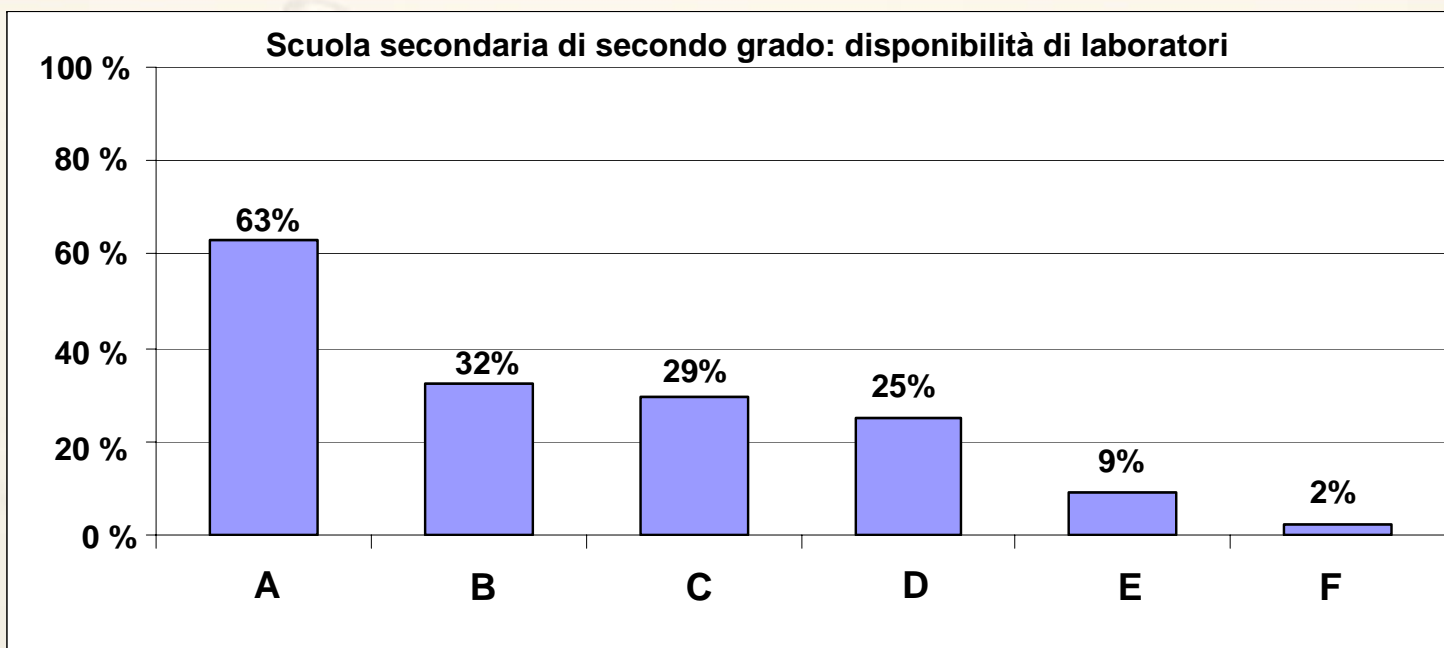
Disponibilità di laboratori nella scuola secondaria di secondo grado



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Total number of laboratories: school form



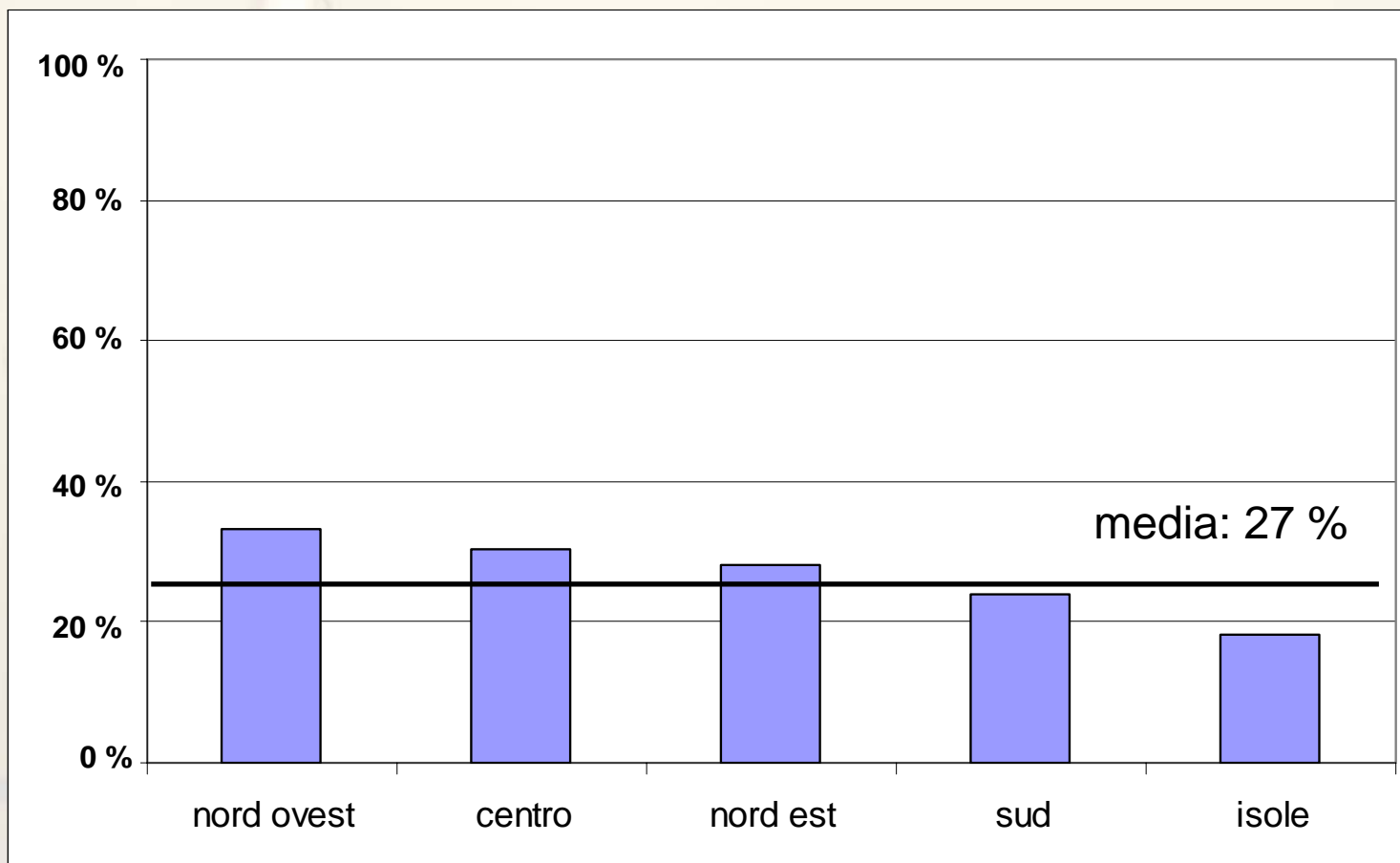
A	Laboratorio specifico e attrezzato per la disciplina
B	Materiali e strumenti, presenti o da trasportare, nelle aule di lezione
C	Aula adibita per eseguire/presentare alcune attività sperimentali
D	Laboratorio di informatica utilizzato per la disciplina
E	Spazi ricavati in androni o corridoi
F	Spazi esterni a disposizione della scuola o a cui la scuola ha accesso (orto, giardino, stagno, staz. met.)

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Which of the following laboratory facilities are available to your subject? – school form

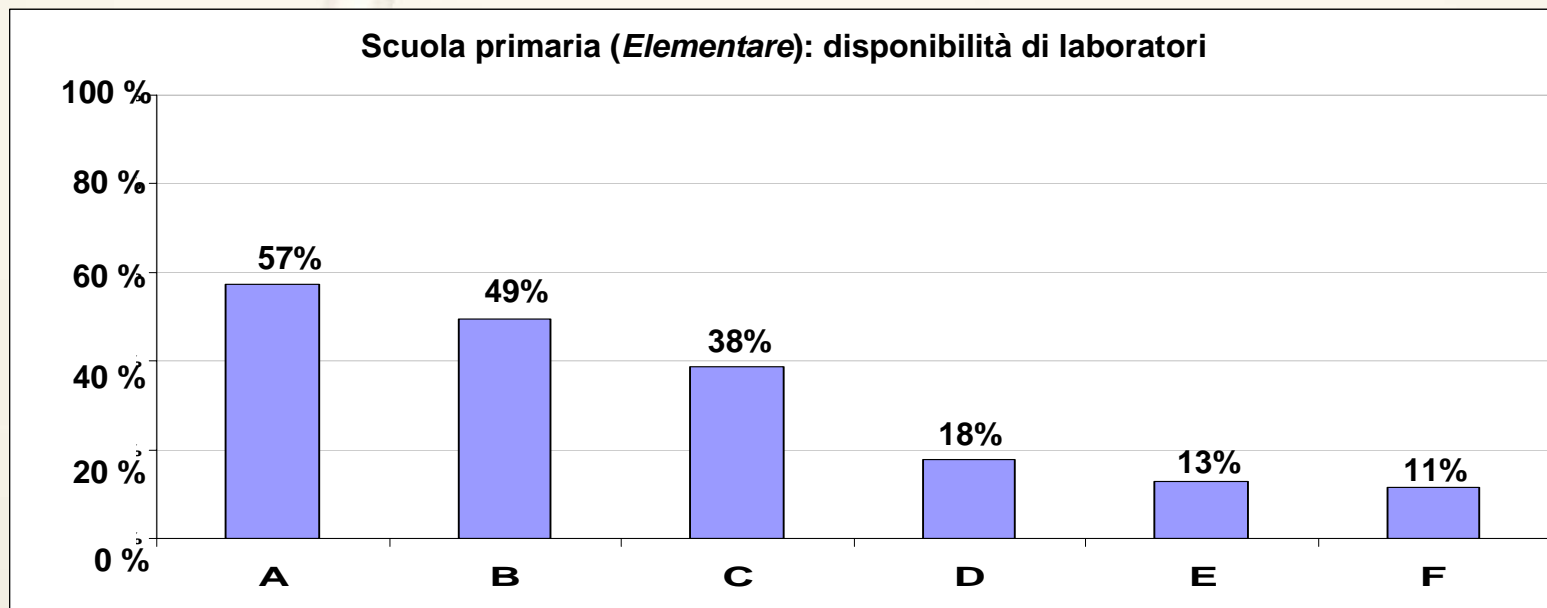
Disponibilità di laboratori nella scuola primaria (Elementare)



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Total number of laboratories: school form

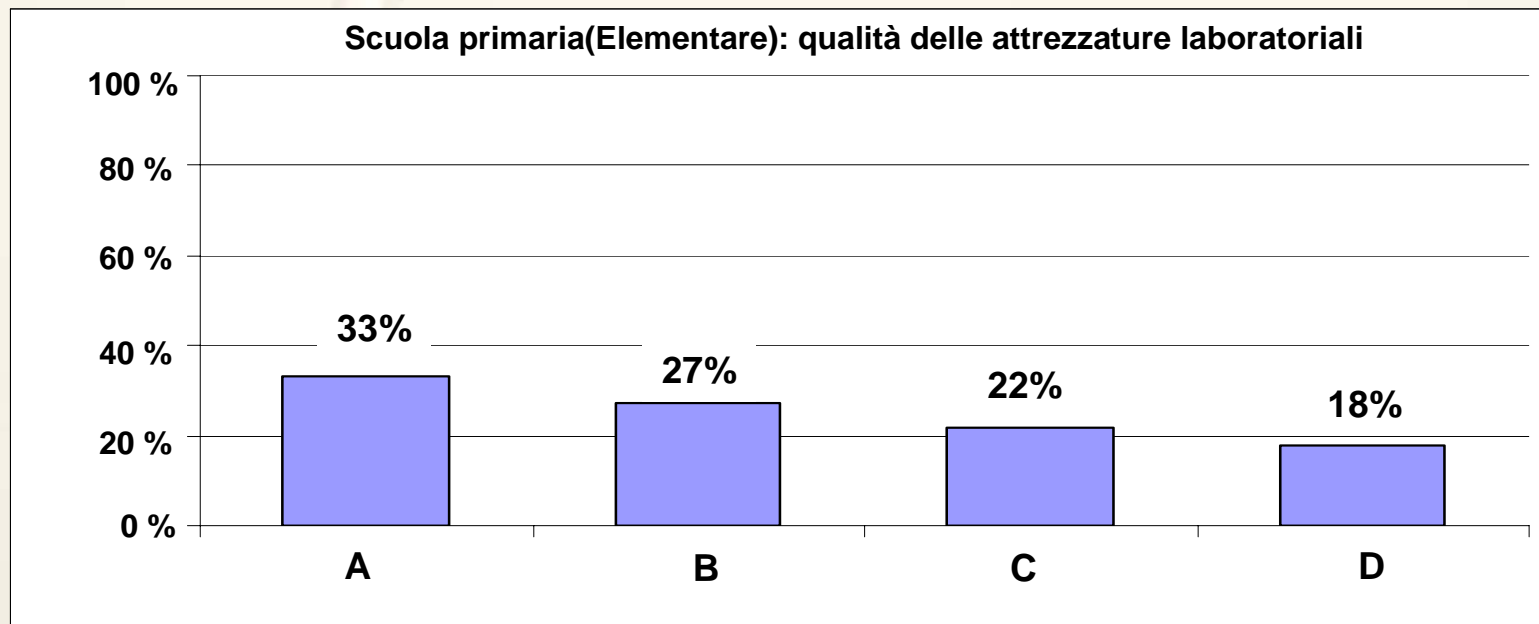


A	Laboratorio di informatica utilizzato per la disciplina
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E	Laboratorio specifico e attrezzato per la disciplina
F	Spazi ricavati in androni o corridoi

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Which of the following laboratory facilities are available to your subject? – teacher form

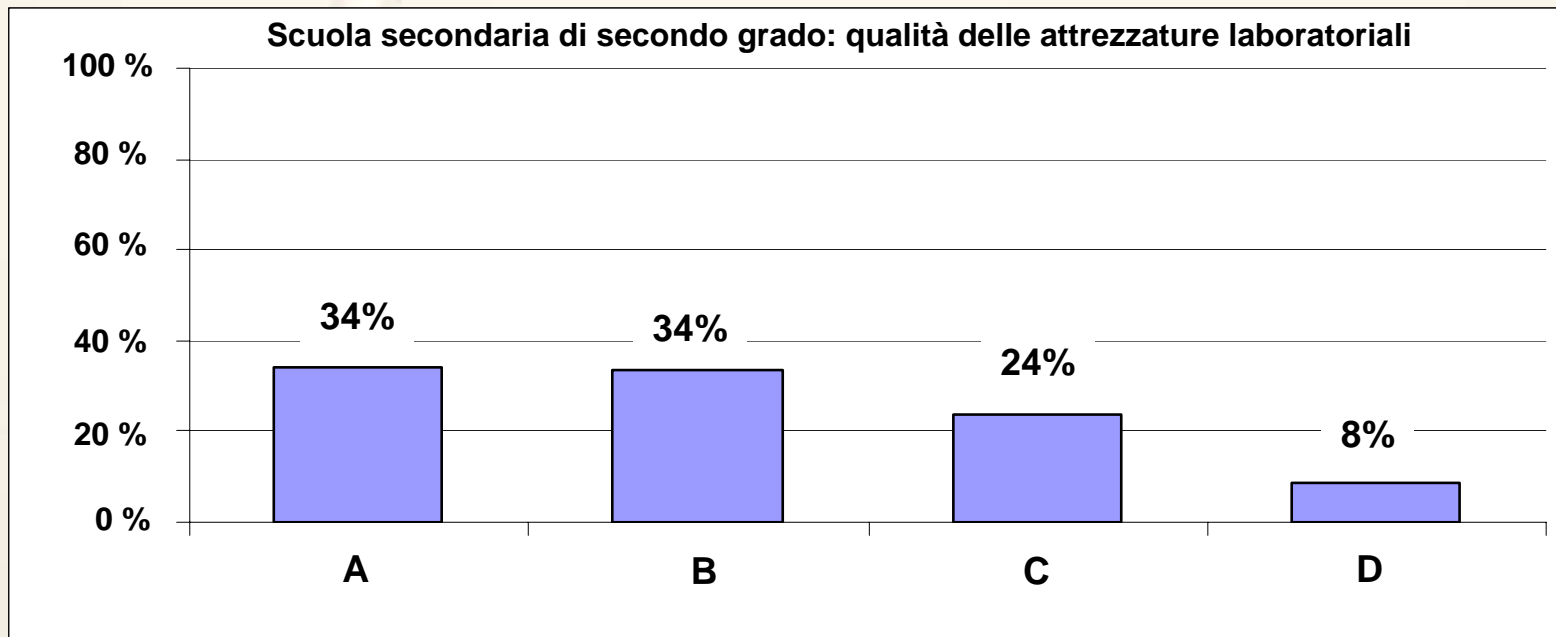


A	Attrezzature antiche, ma utilizzabili
B	Attrezzature moderne ed efficienti
C	Attrezzature moderne, ma obsolete
D	Attrezzature antiche e non utilizzabili

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Laboratory equipment available in your school is to be considered ...



A	Attrezzature moderne ed efficienti
B	Attrezzature antiche, ma utilizzabili
C	Attrezzature moderne, ma obsolete
D	Attrezzature antiche e non utilizzabili

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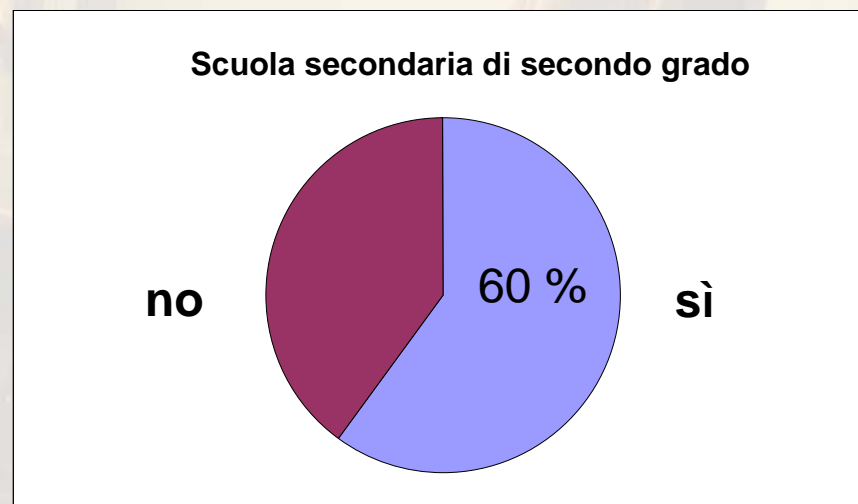
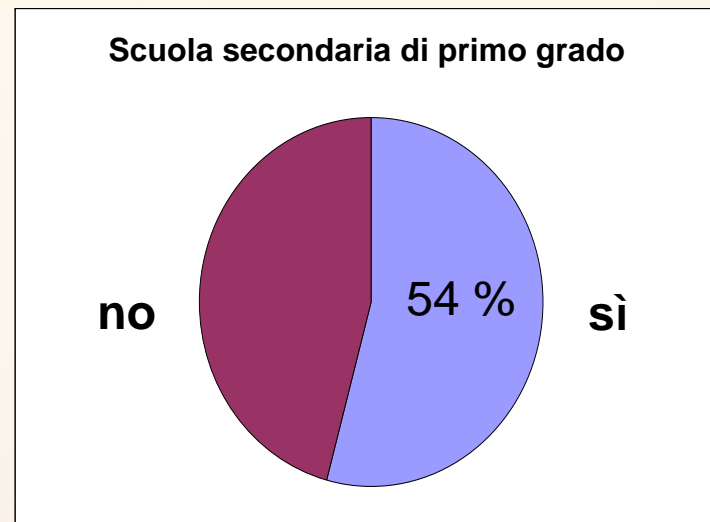
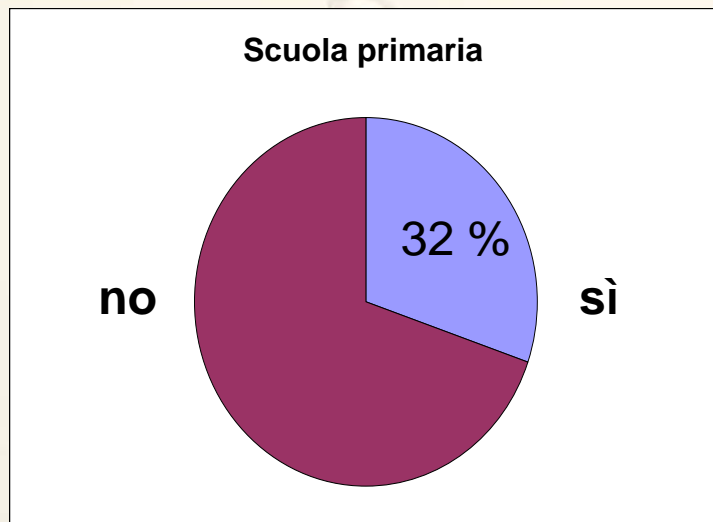


Laboratory equipment available in your school is to be considered ...

EQUIPMENT

Lack of equipment seems even more serious than that of laboratories: only in a third of the middle schools equipment is up-to-date and efficient; this datum is even lower for K12 schools.

A relevant indicator of the variety and flexibility of experiments is represented by the availability of low-cost material; as a matter of fact this rarely happens.



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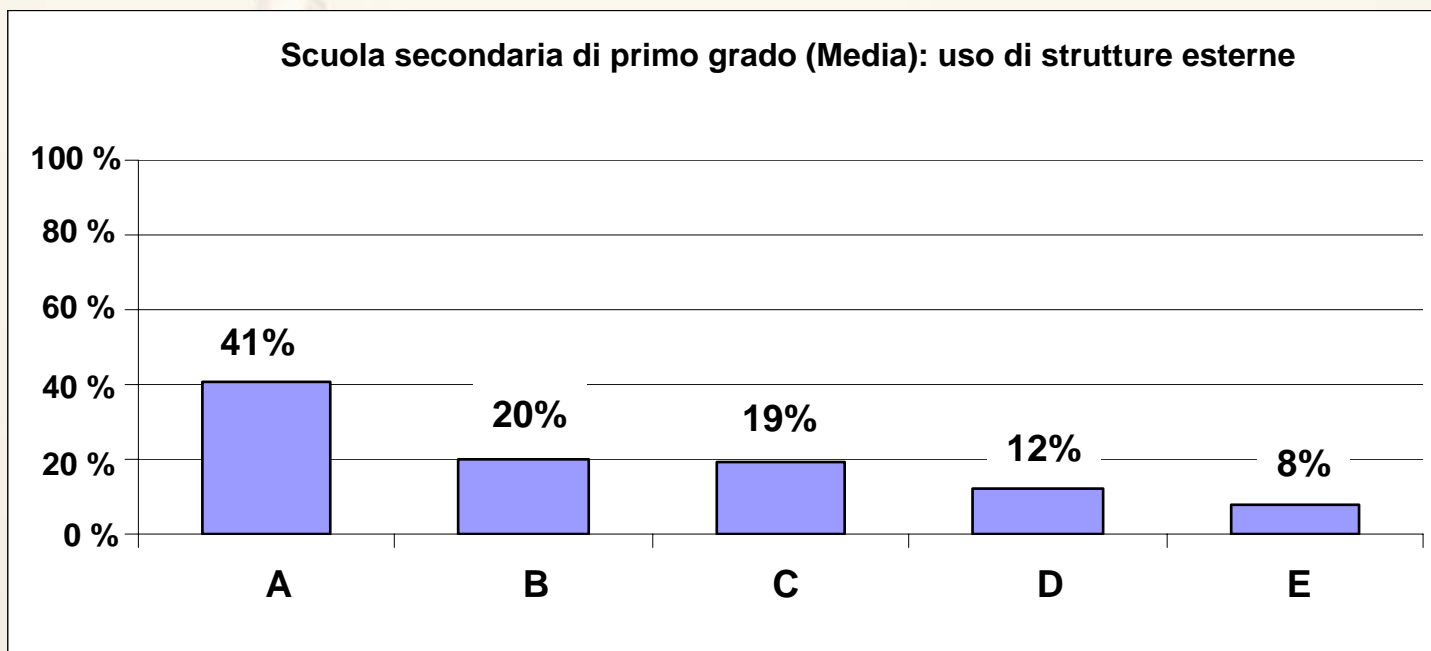


In your school is it easy to purchase low-cost material to build tools and experiments?

EXTERNAL STRUCTURES

In all school systems it is widely accepted that external structures (Museums, research centres, parks etc.) provide indispensable support to Science education.

Our teachers still make insufficient use of these structures, mostly with guided tours, sometimes with demonstrations and very seldom with the active involvement of learners .

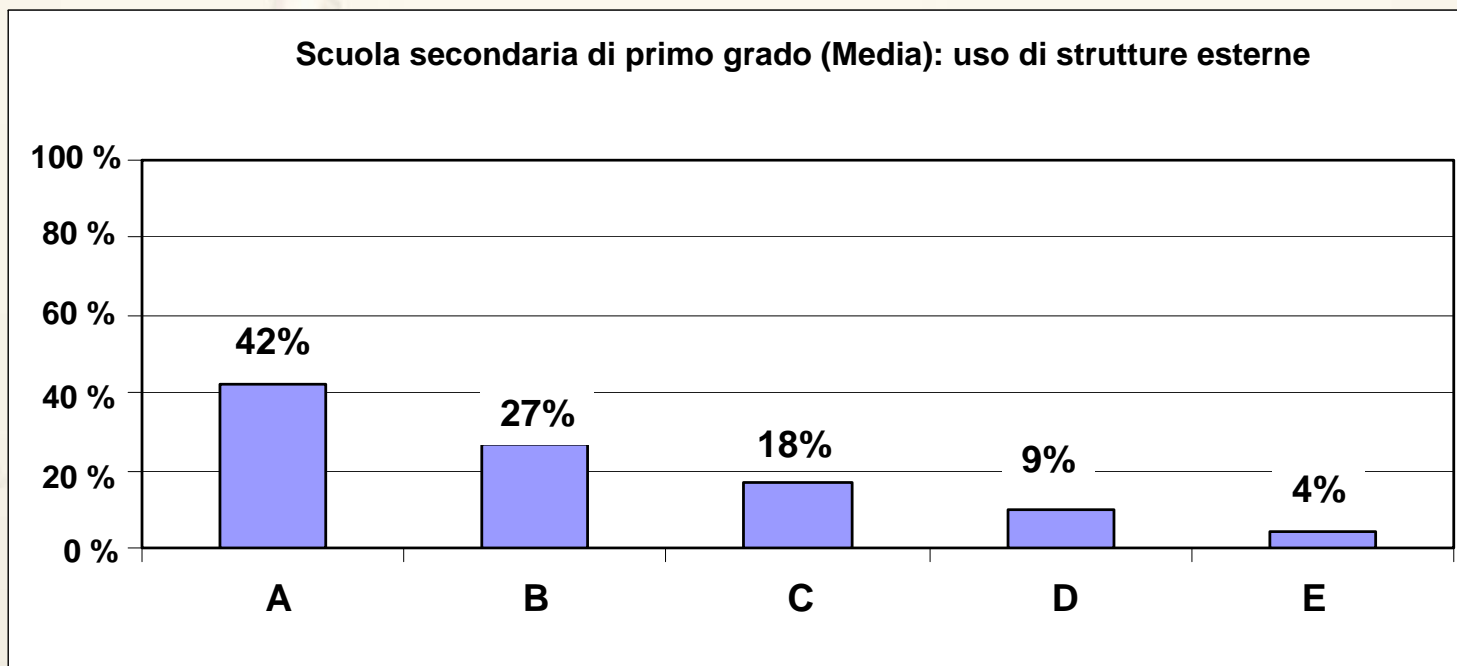


A	Faccio delle visite
B	Assisto ad esperimenti o dimostrazioni
C	Seguo attività' di aggiornamento non sperimentali
D	Sono assistito/lavoro con altri colleghi per trasferire a scuola attività' sperimentali
E	Eseguo esperimenti

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If so, how is the external structure used?
- Teacher -



A	Visite guidate
B	Gli studenti assistono ad esperimenti o dimostrazioni
C	Gli studenti eseguono esperimenti
D	La struttura esterna fornisce istruzioni e guide per eseguire esperimenti a scuola
E	La struttura esterna fornisce materiali e strumenti per eseguire esperimenti a scuola

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*If so, how is the external structure used?
- Learner -*

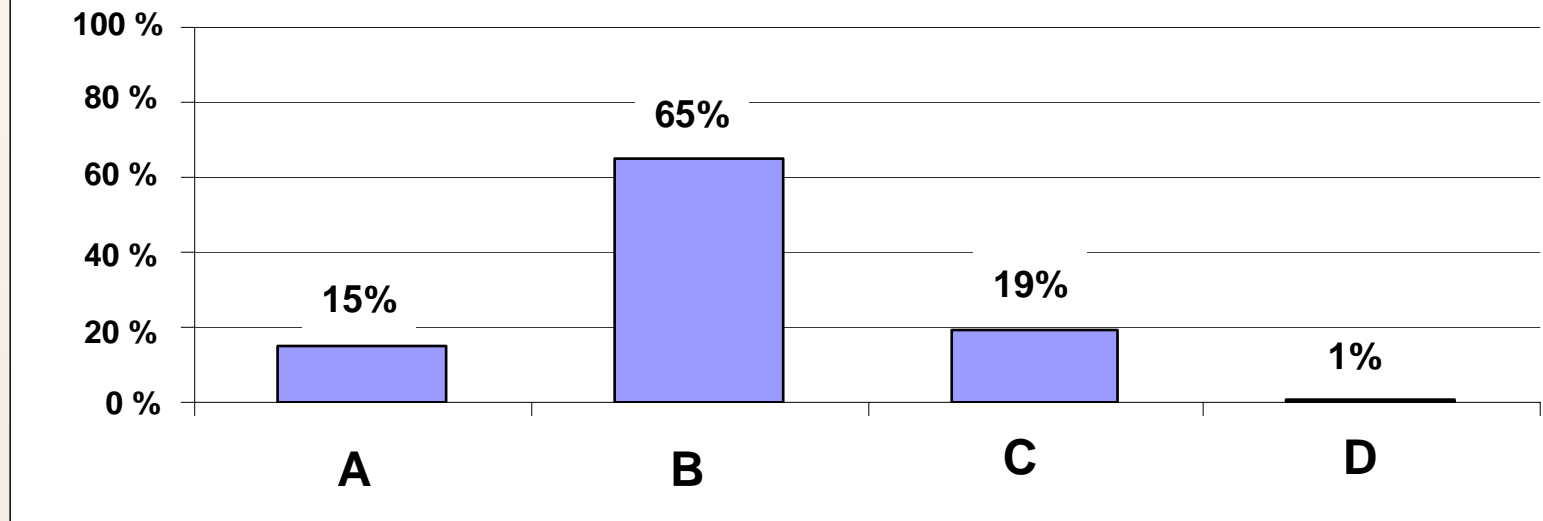
THE TEACHERS

Teachers acknowledge the (relative) importance of the experimental activities for their subject.

Among the critical factors that influence experimental activities teachers rate their own grounding and the availability of structures very highly.

Support experts are systematically available in technical high schools only; their presence is considered more important in high schools than at K12 level; this can be explained by the higher technical complexity of equipment required by the former.

Scuola secondaria di secondo grado: importanza delle attività sperimentali

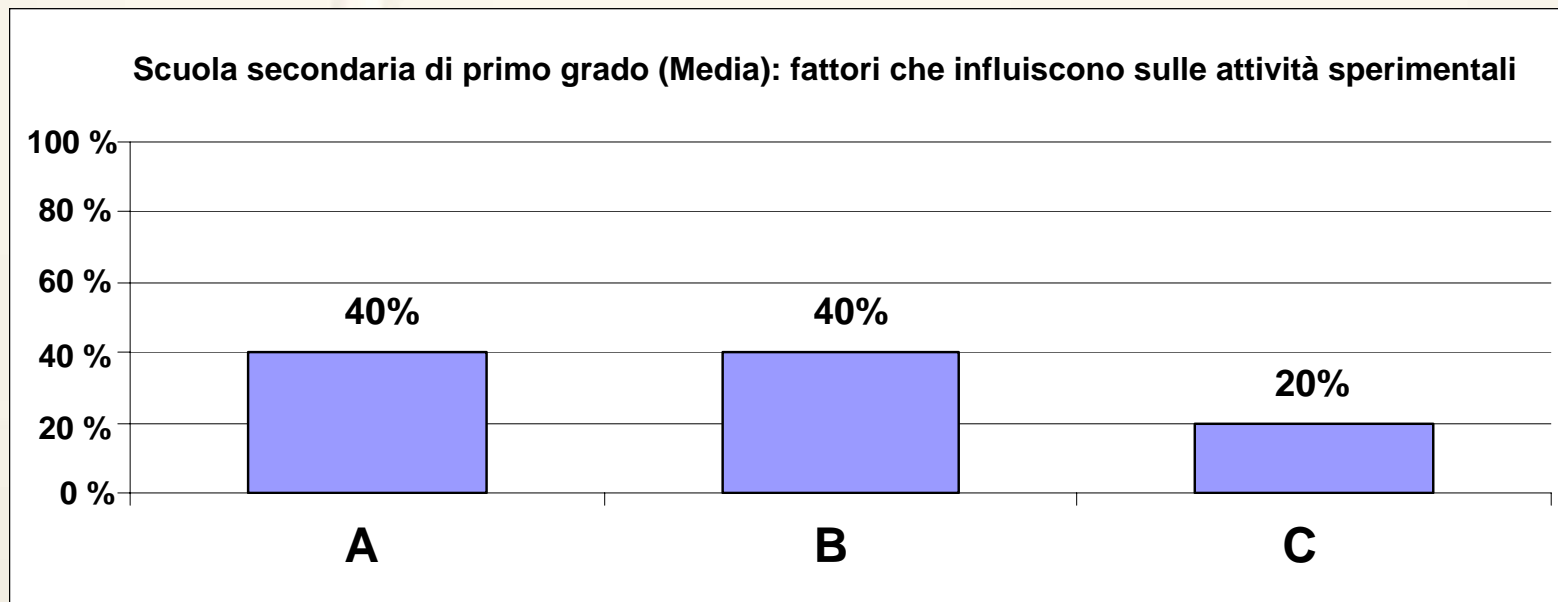


A	Sono la cosa piu' importante, anzi ne sono la vera essenza
B	Sono molto importanti
C	Sono abbastanza importanti, ma non cruciali
D	Non sono importanti. E' molto piu' importante lo studio e la riflessione teorica

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To what extent do you reckon that experimental activities are relevant for your subject?



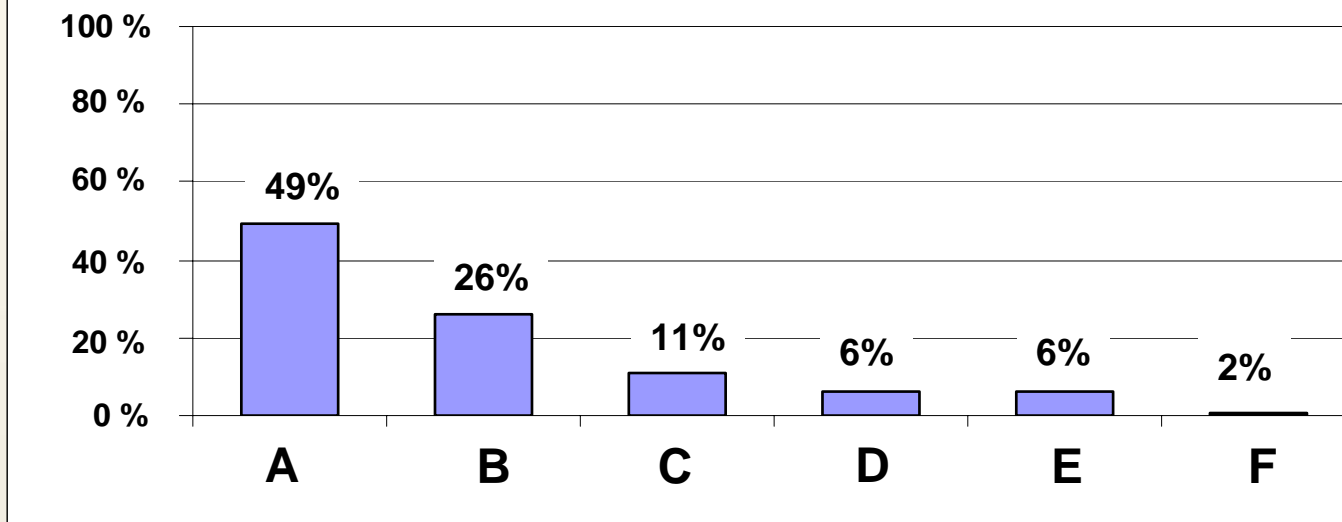
A	Disponibilita' di laboratori
B	Preparazione del docente
C	Disponibilita' del supporto di personale esperto

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Which of the following factors, in your experience, impact on the possibility of developing experimental activities?

Scuola secondaria di primo grado (Media): personale di laboratorio

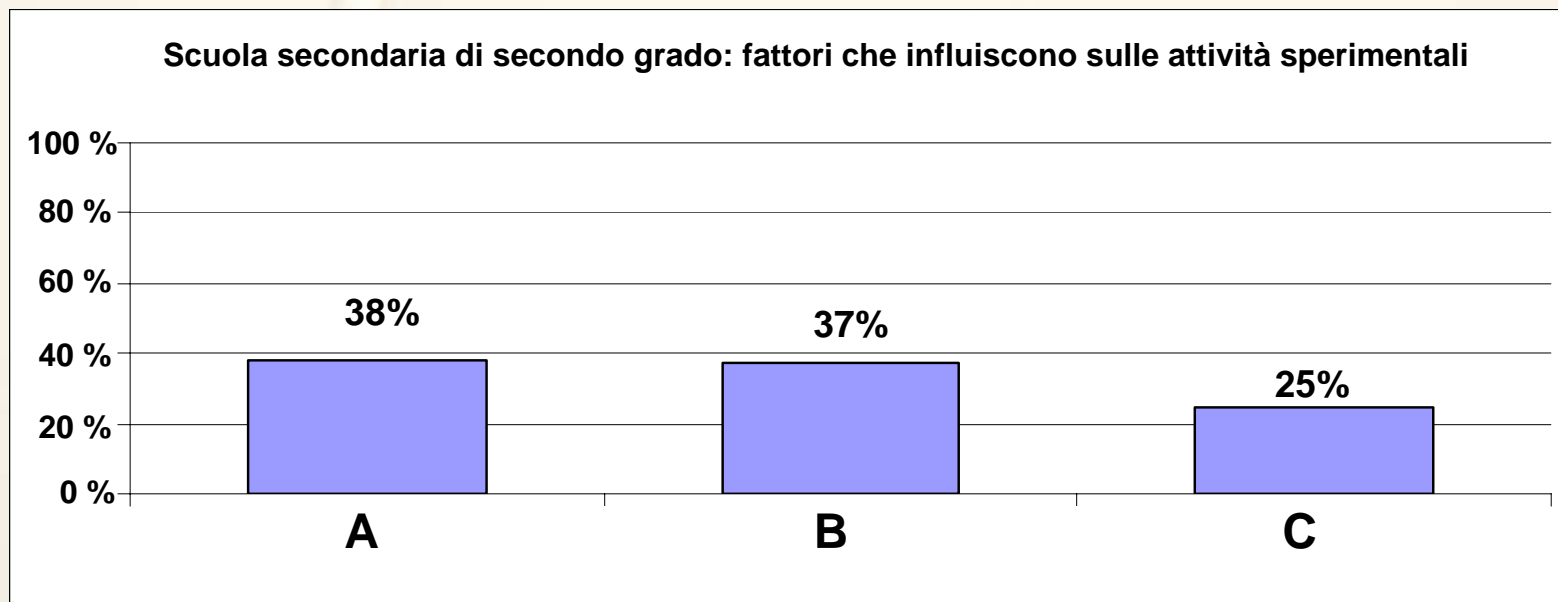


A	Non e' disponibile alcun esperto di laboratorio
B	E' disponibile un insegnante esperto su base volontaria
C	E' disponibile sporadicamente un insegnante esperto con orario a disposizione
D	E' disponibile costantemente personale tecnico
E	E' disponibile costantemente un insegnante esperto con orario a disposizione
F	E' disponibile costantemente personale tecnico

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Support of an expert in laboratory activities

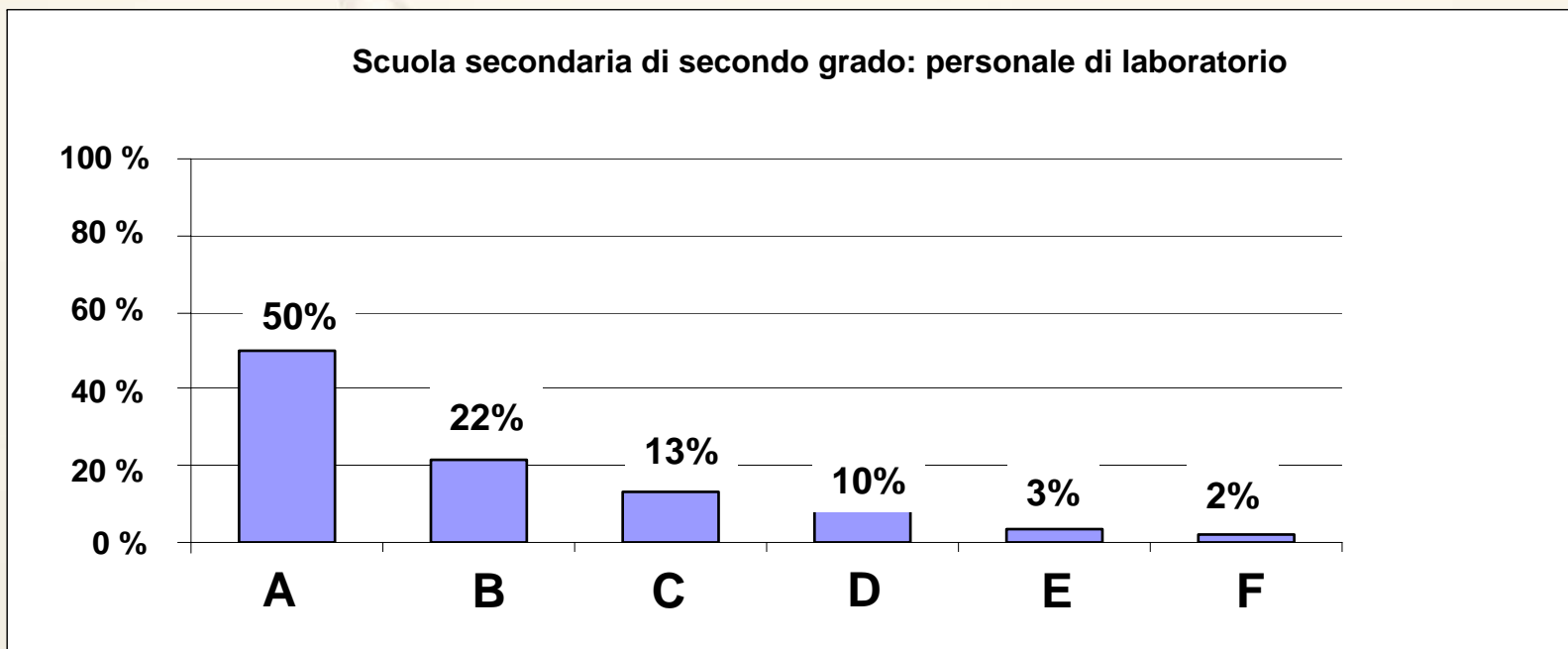


A	Disponibilita' di laboratori
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C	Disponibilita' del supporto di personale esperto

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Which of the following factors, in your experience, impact on the possibility of developing experimental activities?



A	E' disponibile costantemente personale tecnico
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Support of an expert in laboratory activities

CONCLUSIONS

The recommendations of the working group for a systematic policy in favour of laboratory-based instruction are borne out by the outcomes of this survey;

Such policy concerns the facilities that should be more widely available and up-to-date, although the organizational issues are relevant as well.

Teacher education should be an integral part of this policy.

Primary school teachers' initial training

Most students I've been teaching to showed many serious deficiencies in Mathematics, which I tried to put remedy to under the constraint of 60 lecture hours plus 40 lab hours.

Students are only to take another exam in math education: 60 lecture hours plus 40 lab hours.

Mathematics is present at 10% less than overall subjects taught at the School of Education. (Roma Tre)

The vast majority of students would confess they hoped not to have to teach mathematics; they were very happy even to get a low mark, provided they got over the exam.

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