STUDENTS' BELIEFS FOR FORMATIVE ASSESSMENT IN MATHEMATICS TEACHING AND LEARNING

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ABSTRACT

- Description of the purpose and actions of a European research program (***FAMT&L)***
  - examination of formative assessment (F.A) in the teaching and learning of mathematics.

- Questionnaire for tracing the students' beliefs regarding the use of formative assessment in mathematics teaching and learning.

- A part of first results
  - Factors influencing the construction of beliefs about the purpose and the role of F.A.
  - Structural organization of the different dimensions that are related to the construction of the students' beliefs about F.A in mathematics.

NCTM (1995)

Assessment is “the process of gathering evidence about a student’s knowledge of, ability to use, and disposition towards mathematics and of making inferences from that evidence for a variety of purposes”.

What is important, however, is that how we do this and why we do it varies tremendously.

(Dudley & Swaffield, 2008)

Assessment must be formed ***for learning*** and not of learning, as “children have a role in assessment for this purpose since it is, after all, the children who do the learning”.

(Harlen, 2000, p.112).

There is a need for reformation of traditional ways of assessment in education and teaching.

(Qassim, 2008)

FORMATIVE ASSESSMENT

"A process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes."

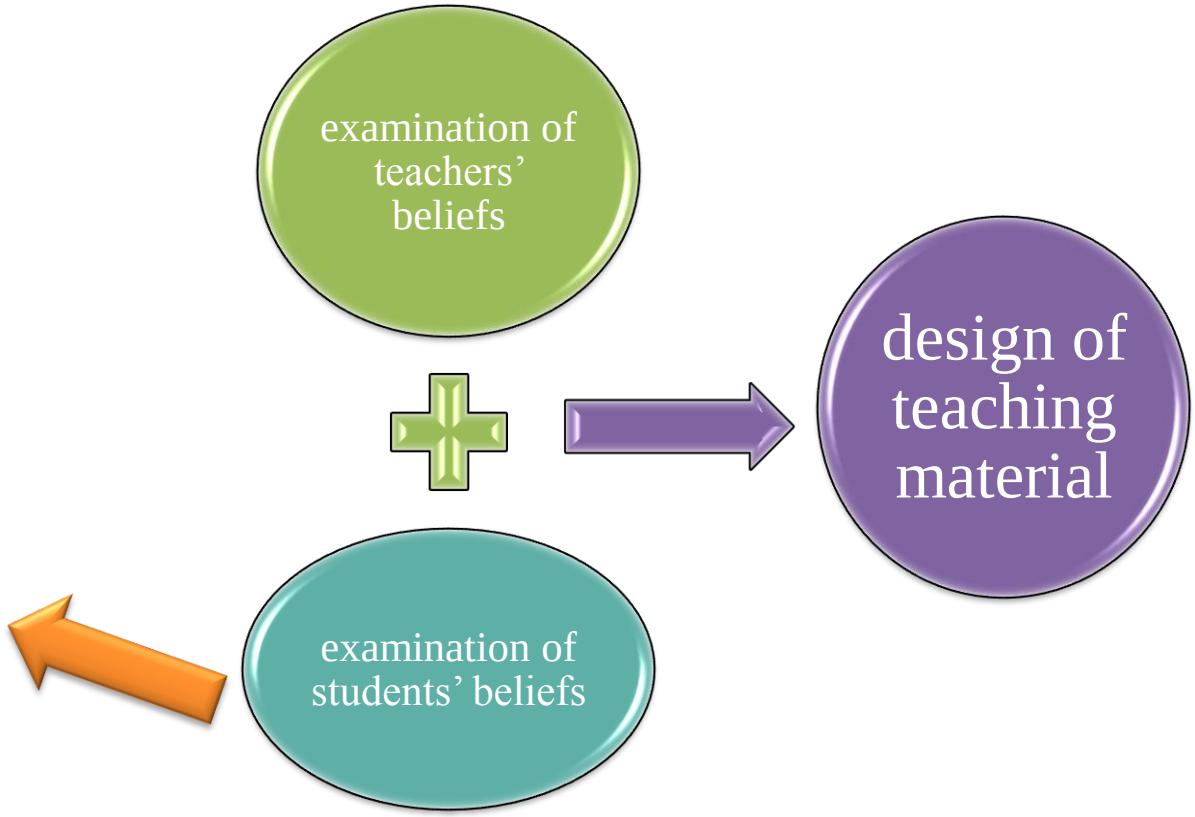
Popham (2008)

FAMT&L

- Aiming at this reformation of ways of assessment
  → teaching material for effective implementation of F.A.

Students' conceptions of assessment are very important because assessment has a significant impact on the quality of learning.

(Ramsden, 1997)



Research questions

- 1. What are the *students' beliefs* for F.A in mathematics?
- 2. What are the *factors influencing* the students' beliefs for F.A in mathematics?
- 3. What is the *structural organization* of the students' beliefs for F.A in mathematics?

The Survey

- **Participants:**

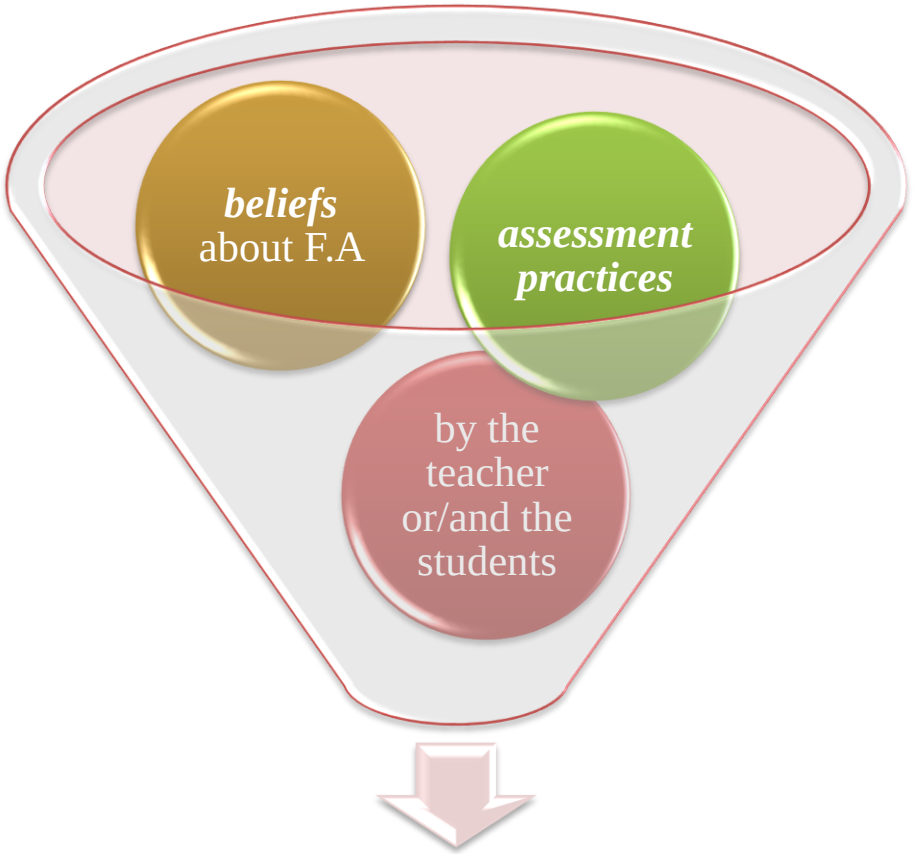
308 Cypriot students aged 12-15.

G7: 108

G8: 72

G9: 128

- **Questionnaire:**
  - Students' beliefs about purpose and use of F.A in mathematics teaching and learning.
  - 44 statements (PURPOSE, TECHNIQUES, RESULTS, USE OF ERRORS)
  - Degree of agreement
  - 4 Likert scale.



relations between particular practices and the formation of positive or negative beliefs.

RESEARCH AXES	REPRESENTATIVE STATEMENTS
PURPOSE (N=10)	•Assessment helps me identifying my good skills in math. •Some assessments serve to verify only what I have understood on a mathematical subject and not for our grade report.
TECHNIQUES (N=8)	***How important do you think are the following methods of assessment in math?*** ▪ Test with Multiple choice tasks ▪ Test with True – False tasks ▪ Homework ▪ Participation in class ▪ Portfolio ▪ Peer-Feedback ▪ Self- assessment ▪ Individual interviews
USE OF ERRORS (N=6)	▪ Correcting my mistakes helps me to understand better a mathematical concept ▪ My mistakes in math discourage me. ▪ My teacher uses our mistakes and interests to plan the next mathematics lesson. ▪ If I make mistakes in math I deserve a low grade.
STAKEHOLDERS (N=20)	▪ After a classmate marking my test or work in math, I can acknowledge my mistakes easier. – ***STUDENTS*** ▪ My teacher's goal of assessment is identifying my learning difficulties in math in order to help me to overcome them.. – ***TEACHERS*** ▪ My parents make comments about my corrected tests or works in math, even if I get low or high grades. – ***PARENTS***

DESCRIPTIVE STATISTICS

BELIEFS	PURPOSE	TECHNIQUE	RESULTS	STAKEHOLDERS
ALL	2,71	2,31	2,50	2,46
GRADE 7	2,71	2,42	2,57	2,45
GRADE 8	2,60	2,42	2,57	2,45
GRADE 9	2,70	2,27	2,47	2,48

No striking differentiations between the different groups of students in each group of statements.

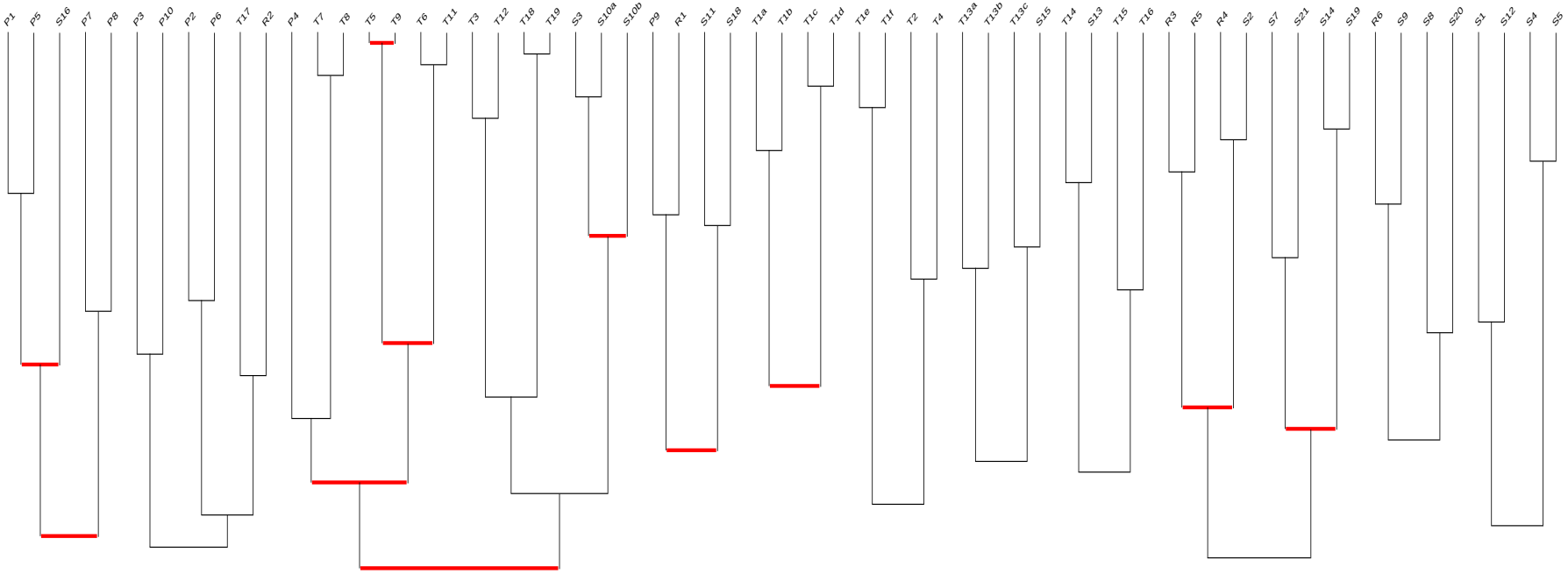
The hierarchical clustering of variables

- **The hierarchical clustering of variables** is a classification method which aims to identify in a set V of variables, sections of V, less and less subtle, established in an ascending manner.

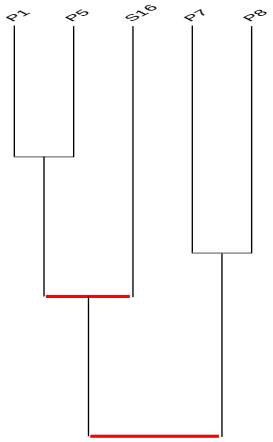
- This kind of analysis allows the researcher to study and interpret clusters of variables in terms of typology and decreasing resemblance.

- This aggregation may be indebted to the conceptual character of every group of variables.

SIMILARITY DIAGRAM



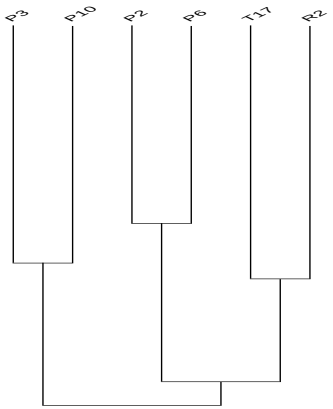
11 similarity clusters



P1	Assessment helps me identifying my good skills in math.
P5	When feedback is continuous I feel I have a foundation that helps me to understand what I am learning in math.
S16	When it is clear to me what and how to learn in a mathematics class, I become a more motivated and engaged learner.
P7	I feel more confidence about myself when I have more frequent feedback about my progress in a mathematic subject.
P8	Assessment information motivates me to set new goals in learning math.

Continuous feedback and the knowledge of criteria for learning increases the students motivation, engagement and understanding and leads to the creation of positive beliefs towards the purpose of assessment.

Cluster 1: The positive effect of F.A on the students' affective domain (self-concept, motivation)



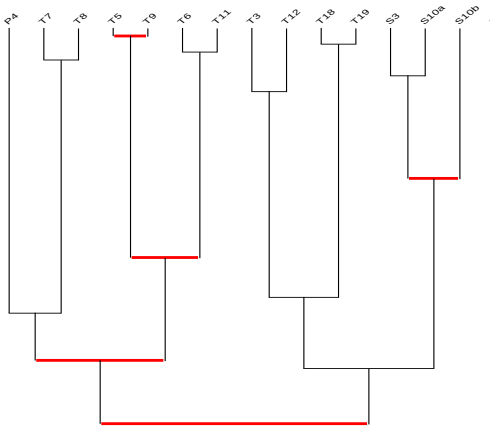
P3	The grades that I receive on a math test cannot show if I have understood the mathematical subjects I have been taught.
P10	The grades and the reports in math do not force me to work when I don't want to do.
P2	Assessment does not help me facing my difficulties on a mathematical subject.
P6	Assessment in math provokes me anxiety.
T17	The teacher has not any time to explain me what I don't understand.
R2	My mistakes in math discourage me.

- Bad teachers' practices (no time for feedback) leads to negative beliefs about FA (purpose) and negative effects of FA on the students' affective domain (anxiety, motivation).

- The students' focus on grading is related to these negative affects.

Cluster 2: The negative effects of bad assessment practices on the students' beliefs and affective domain.

P4	Some assessments serve to verify only what I have understood on a mathematical subject and not for our grade report.
T7	Peer-Feedback
T8	Self- assessment
T5	Project
T9	Individual interviews
T6	Presentation of works, reports etc
T11	Group activities
Assessment techniques allowing students' engagement – positive belief about purpose of FA	
T3	Portfolio
T12	Other
T18	After an assessment my teacher uses to give different mathematical activities at each student, in order to help us promote our good skills in math.
T19	After an assessment my teacher differentiates the activities that he gives us according to our interests.
S3	On my corrected work in math, I make comments that tell me what I have done well.
	My math teacher uses to call my parents to make a discussion:
S10a	• before my assessment.
S10b	• after my assessment.
Differentiation / self-assessment / parents	

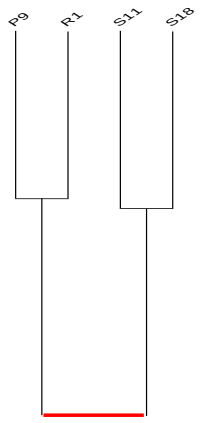


Cluster 3: Factors that contribute to the formation of positive beliefs for F.A:

❑Students' engagement (assessment methods / Self-assessment)

❑Differentiation

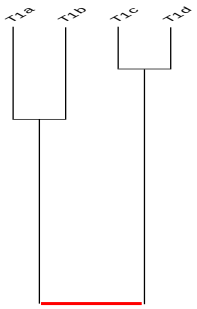
❑ Teacher-parents effective cooperation



P9	When I am not satisfied about the grades that I have received for my working in math, I have to try harder.
R1	Correcting my mistakes helps me to understand better a mathematical concept.
S11	My parents make comments about my corrected tests or works in math, even if I get low or high grades.
S18	It's more important for me to understand the mathematical knowledge I am taught than to get high grade.

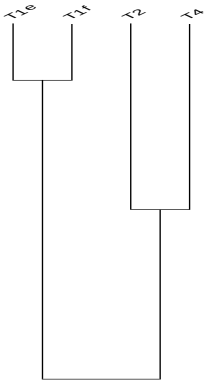
The students with internal motivation face grades, mistakes and parents involvement positively (as feedback).

Cluster 4: The relation of the students' internal motivation with the construction of positive beliefs.



How important do you think are the following methods of assessment in math?	
T1a	1a. Test with Completion tasks
T1b	1b. Test with Multiple choice tasks
T1c	1c. Test with True – False tasks
T1d	1d. Test with Matching tasks

Cluster 5: Less preferable assessment methods



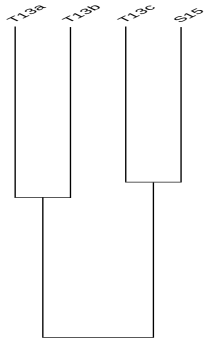
How important do you think are the following methods of assessment in math?	
T1e	1e. Test with Closed-ended tasks
T1f	1f. Test with Open-ended tasks
T2	2. Participation in class
T4	4. Homework

Cluster 6: Most preferable assessment methods

The students' discrimination of the different assessment techniques according to their preferences.

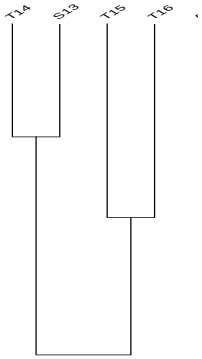
ASSESSMENT TECHNIQUES

QUESTION	MEAN
1a. Test with Completion tasks	2,46
1b. Test with Multiple choice tasks	2,62
1c. Test with True – False tasks	2,80
1d. Test with Matching tasks	2,45
1e. Test with Closed-ended tasks	2,29
1f. Test with Open-ended tasks	2,55
2. Participation in class	3,10
3. Portfolio	1,97
4. Homework	2,80
5. Project	2,01
6. Presentation of works, reports etc	2,13
7. Peer-Feedback	2,30
8. Self- assessment	2,23
9. Individual interviews	1,81
11. Group activities	2,27



	My teacher assesses our skills and knowledge:
T13a	• before the instruction of each mathematic concept.
T13b	• during the instruction of each mathematic concept.
T13c	• after the instruction of each mathematic concept.
S15	I prefer to know the criteria that my teacher uses for my assessment in math.

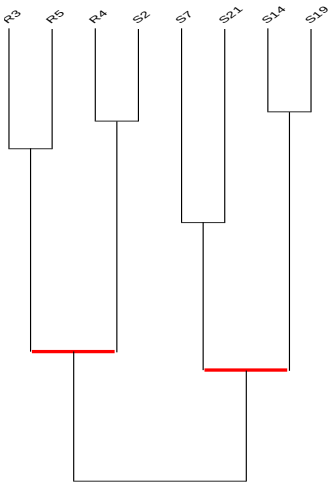
Cluster 7: Conditions of assessment (when - how)



T14	After an assessment, my teacher develops mathematical tasks which will help me to face my difficulties in a mathematical subject.
S13	My teacher's goal of assessment is identifying my learning difficulties in math in order to help me to overcome them.
T15	For improving students who fail in mathematics, the teacher explains again a mathematical topic.
T16	On my corrected works in math, my teacher makes comments that tell me what I have done well.

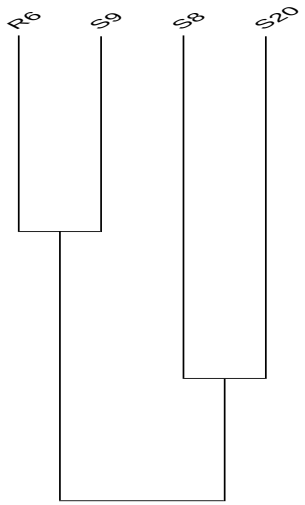
The teachers' "feed-forward" actions after assessment leads to the creation of positive beliefs about F.A.

Cluster 8: The role of feed-forward activities on the creation of positive beliefs for F.A



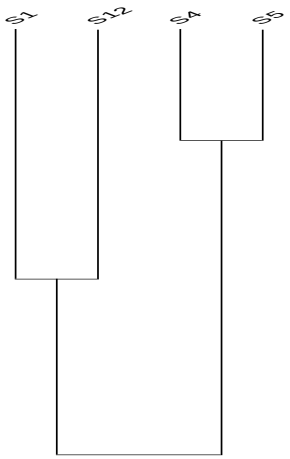
R3	After an assessment in math, my teacher wants to verify if I have understood the mistakes that I have made.
R5	My math teacher wants to be with me while I am correcting my mistakes.
R4	My teacher uses our mistakes and interests to plan the next mathematics lesson.
S2	After an assessment in math, my teacher asks me to make a self-assessment on my corrected work.
Feed-forward activities – use of mistakes	
S7	Peer review leads to differentiate the good students from non-good.
S21	To be successful in math, I have to be more successful than the rest of the students in my classroom.
S14	I use to discuss with my teacher his/ her own expectations before an assessment in math.
S19	I usually create a personal check list in order to assess myself in math.
Setting success criteria (student, teacher, peer)	

Cluster 9: The relation between the teachers' feed-forward activities and the students' development of good practices for defining self – concept.



R6	If I make mistakes in math I deserve a low grade.
S9	I prefer not comparing my results in math with my classmates in order to avoid their derision.
S8	Having the students correcting each other's work in class leads to increase the competitiveness among them.
S20	If I don't know the grades of my classmates I am not able to know if I have succeeded in math.

Cluster 10: The negative effects of assessment in the students' affective domain (self-image, competitiveness).



S1	Where appropriate, I am involved in decisions about how the assessment in math will take place.
S12	When I am assessed in math, I usually do a working without knowing precisely what I am expected to do.
S4	After a classmate marking my test or work in math, I can acknowledge my mistakes easier.
S5	The opinion of the good students about my test or my work in math is more important for me than the opinion of the rest students

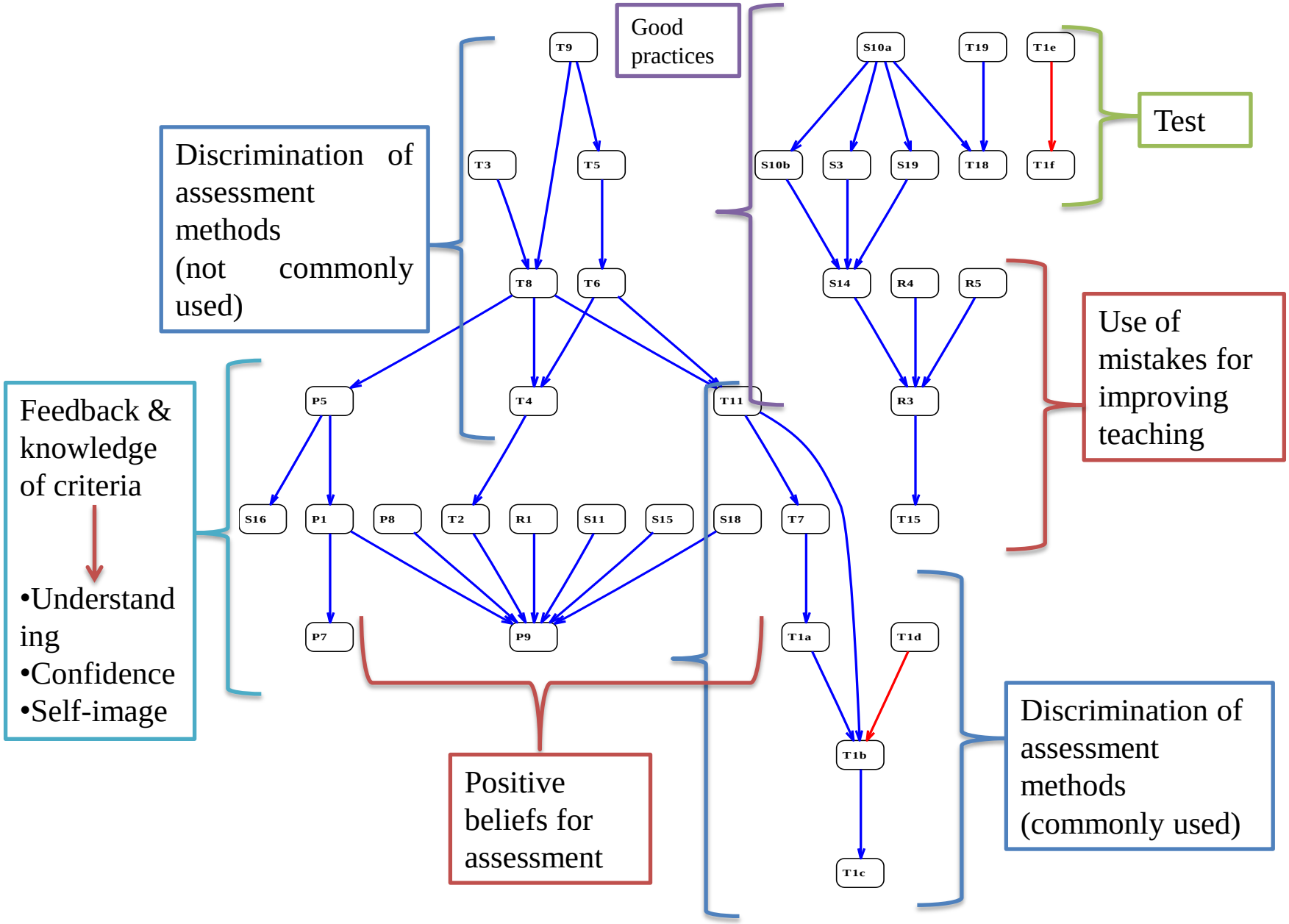
Cluster 11: The students' engagement in assessment (setting criteria, the importance of peer assessment.

The implicative statistical analysis

- The implicative statistical analysis aims at giving a statistical meaning to expressions like: *"if we observe the variable A in a subject, then in general we observe the variable B in the same subject"*.

- Thus the underlying principle of the implicative analysis is based on the quasi-implication: "*if A is true then B is more or less true"*.

Implicative diagram _ All students_All statements_Cyprus



Conclusions

Factors that contribute to the construction of the students' beliefs about assessment.		
	Positive beliefs	Negative beliefs
Students	❑Students' knowledge of assessment conditions (criteria, time etc.) ❑Use of grades for feed-back. ❑Students' engagement (Assessment methods / Self/ Peer – assessment). ❑Students' internal motivation	❑Unawareness of the assessment criteria. ❑Focus on grading.
Teachers	❑Continuous feedback. ❑Feed-forward activities. ❑Differentiation. ❑Effective use of mistakes (for feed-forward). ❑Teacher-parents effective cooperation.	❑Bad teachers' practices (no time for feedback). ❑Use of not preferable methods of assessment.
Parents	❑Parents' involvement.	

Conclusions

- Specific teachers' practices (feedback, feed-forward, differentiation, collaboration with parents etc) influence positively the students' beliefs.

- The role of each stakeholder in the F.A process appears to be a factor determining the students' affective domain in relation to F.A.

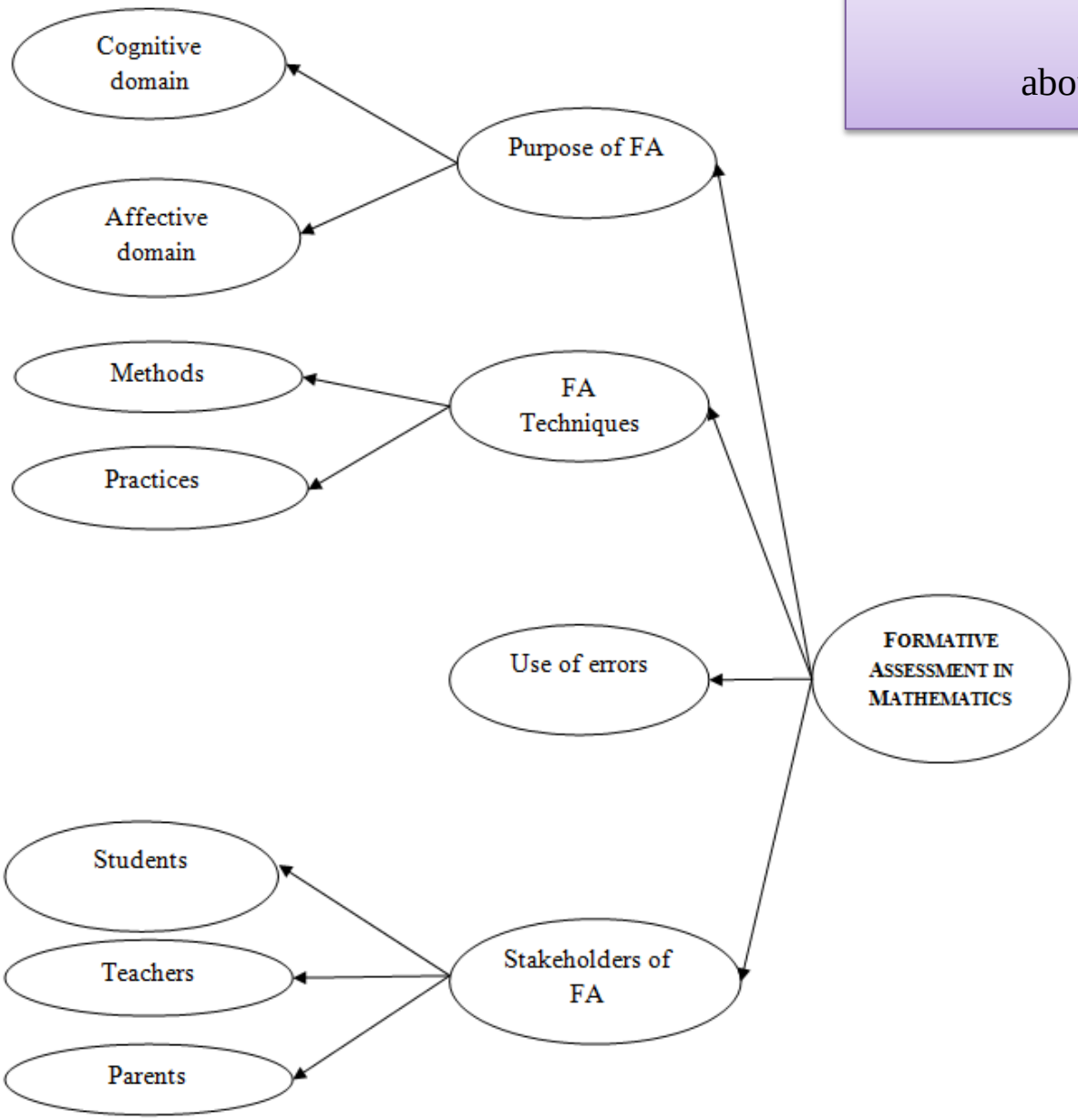
- The practices that appear to influence positively the students' beliefs for F.A should be enhanced and will be used for designing the training model for teachers for implementing effectively F.A practices.

Reflection about….

1)the definition

2) the model

The proposed model of the
students' beliefs
about FA in mathematics



DEFINITION OF FAMT&L

PURPOSE	TECHNIQUES	RESULTS
TEACHERS		

• assessment FOR teaching and learning
• regulates teaching-learning process
• establish a dialogue between teacher and student
	• teaching methodologies which can respond effectively
	  ○ to different learning times for each student
	  ○ their different learning styles
	  ○ their zones of proximal development
	• formative
	  ○ Feedback
	  ○ Feed forward
		• allows teachers to reflect on and modify their own practices.
		• design educational interventions
		• the outputs of teacher's choices (transposition of mathematical contents, interface between contents and methods)".

STUDENTS		
• students to acquire the basic skills of a discipline • identify the strengths and weaknesses of student's learning • to give information, feedback and feed forward – in and outside of the classroom – related to the development of mathematical life-skills	• promotes students' ability for self-assessment and peer-assessment	• learning for all students through differentiated teaching (different rhythms and different teaching and learning strategies) • students' active participation in the teaching-learning process. • involving the student in the analysis of own errors / weaknesses


Thank
You