

A Teacher-dedicated Tool Supporting Personalization of Activities

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PERSONALIZATION OF ACTIVITIES

- A topical issue in research in educational technologies
 - A complex and time-consuming task
 - Diversity of learners
 - Variety of study situations
 - Variety of study subjects
 - Lack of adequate tools
- ⇒ Teachers do not efficiently personalize pedagogical activities
- ⇒ Need to develop software to assist them in the personalization task

PERSONALIZATION OF ACTIVITIES

- Multi-faceted research question
 - Paper and pencil activities
 - Interactive Learning Environments (ILEs)
 - Interactions between teachers or interactive environments and students
 - Etc.
- Learner profiles (Jean-Daubias et al. 2005)
 - Elements characterizing knowledge, skills, perceptions, and/or behaviour
 - Collected or deduced from pedagogical activities which can be computerized or not
- The Adapte module
 - A generic tool aimed at personalizing pedagogical activities
 - Paper and pencil or computerized activities
 - Based on learners profiles

OUTLINE

- A Case-study
- Our approach
 - Principles of Adapte
 - EPROFILEA environment
- Challenges addressed by Adapte
 - What help for the teacher ?
 - What sort of expertise does Adapte need ?
- Theoretical & technical needs of Adapte
- Mechanism of Adapte
 - Knowledge bases
 - Steps of process
- Conclusion

A CASE-STUDY

Personalization of pedagogical activities in a classroom

- A eight-year pupils classroom
- Utilization of ILE of the geography domain
 - ⇒ Generation of a **numeric profile** for each learner
 - ⇒ One subject: geography
- French national assessments
 - ⇒ Diagnosis for each learner = **paper and pencil profile**
 - ⇒ Information on achievements, mistakes and difficulties
 - ⇒ Two subjects: mathematics and French

A CASE-STUDY

Personalization of pedagogical activities in a classroom

- The teacher wants:
 - Personalized exercises sheets (called **worksheets**) for each learner
 - To define the parameters of the geographic ILE in order to design learning **sessions**
- For this purpose, the teacher exploits
 - The learner's skills in the subject of worksheets / ILE
 - The learner's skills in other subjects: French, etc.
- Difficulties:
 - Lack of time to process all information available in the profiles
 - Absence of tool helping teachers in their personalization task

RELATED WORK

Automatic personalization of ILEs

- Through the learner model contained in ILEs
(Burton 1982, Sormo et al. 2002, Vu Minh et al. 2006)
 - ⇒ ILE offers sessions suited to each learner
 - ⇒ **But** the teacher are not involved in the decision process of the system
- Through an administrator interface
(Duclosson et al. 2005, Nicaud et al. 2003)
 - ⇒ The teacher himself defines the parameters of the sessions proposed to the whole class or to each student
 - ⇒ **Then** the teacher produces an important work

(Burton 1982). *Diagnosing bugs in a simple procedural skill*. Intelligent Tutoring Systems. London, Academic Press.

(Duclosson et al. 2005). *AMBRE-enseignant: un module partenaire de l'enseignant pour créer des problèmes*. EIAH'2005, Montpellier.

(Nicaud et al. 2003). *A computer program for the learning of algebra: description and first experiment*. PEG Conference, St. Petersburg.

(Sormo et al. 2002). *Knowledge communication and CBR*. ECCBR 2002.

(Vu Minh et al. 2006). *A Bayesian Network Based Approach for Student Diagnosis in Complex and Ill-structured Domains*. TICE'2006, Toulouse.

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OUR APPROACH

Principles of Adapte

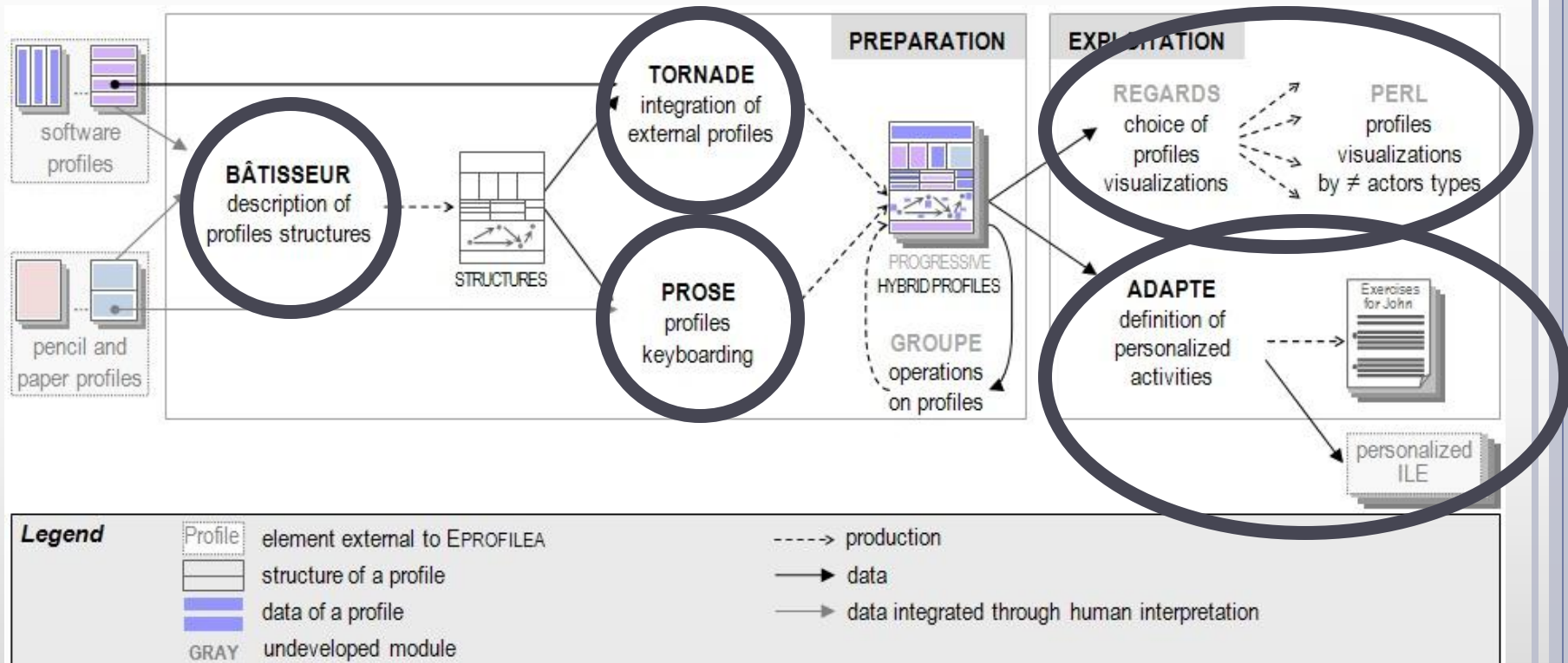
○ Adapte

- A tool dedicated to personalization of pedagogical activities
- ILE activities or paper and pencil worksheets
- Personalization based on
 - Learners profiles
 - Pedagogical goals of teachers

○ Context: PERLEA project (Jean-Daubias et al. 2005)

- Aim: improving the integration of ILEs in education
 - By supporting interactions between teachers and ILEs
 - In a generic way
- EPROFILEA environment
 - Manipulation of existing profiles
 - Two main steps: integration of profiles and reuse of these profiles

EPROFILEA ENVIRONNEMENT



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CHALLENGES ADDRESSED BY ADAPTE

What help for the teacher?

- Role of the Adapte module
 - To provide learners with activities suited to their profiles
 - Paper and pencil activities or computerized activities
- Paper and pencil activities
 - Generation of exercises
 - Specification of the size and/or duration of the worksheets
- Computerized activities
 - ILE is customizable
 - Via configuration files : modification of configuration files
 - Administrator interface: creation of instructions sheets for the teacher
 - ILE is not customizable
 - Creation of lists of exercises that each learner will have to do
 - Specification of exercises number, curriculum, session duration

CHALLENGES ADDRESSED BY ADAPTE

What sort of expertise does Adapte need?

- Expertise provided by each teacher
- Teaching strategy = rules to assign activities of a learner according to teaching practices of each teacher
 - 1 - definition of constraints on the learner profile
 - 2 - definition of constraints for generating or selecting an activity
 - Assignment rule = link between (1) and (2)
 - Teaching strategy = rules organized into a hierarchy
- Teaching situation
 - General constraints: duration of work session, available material (computer or not), etc.
 - Exception constraints for particular learners

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THEORETICAL & TECHNICAL NEEDS OF ADAPTE

○ Paper and pencil activities

- Typology of exercises, for all disciplines
- 15 types of exercises (exercises patterns)
- Associated with a set of semi-automatic generators

○ Computerized activities

- Need of knowledge specific to each ILE
 - Pedagogical knowledge: parameters impacting the personalization, competences involved, etc.
 - Technical knowledge: location of configuration files, existence and use of an exercises generator, etc.
- Provided by an expert or by the ILE designer

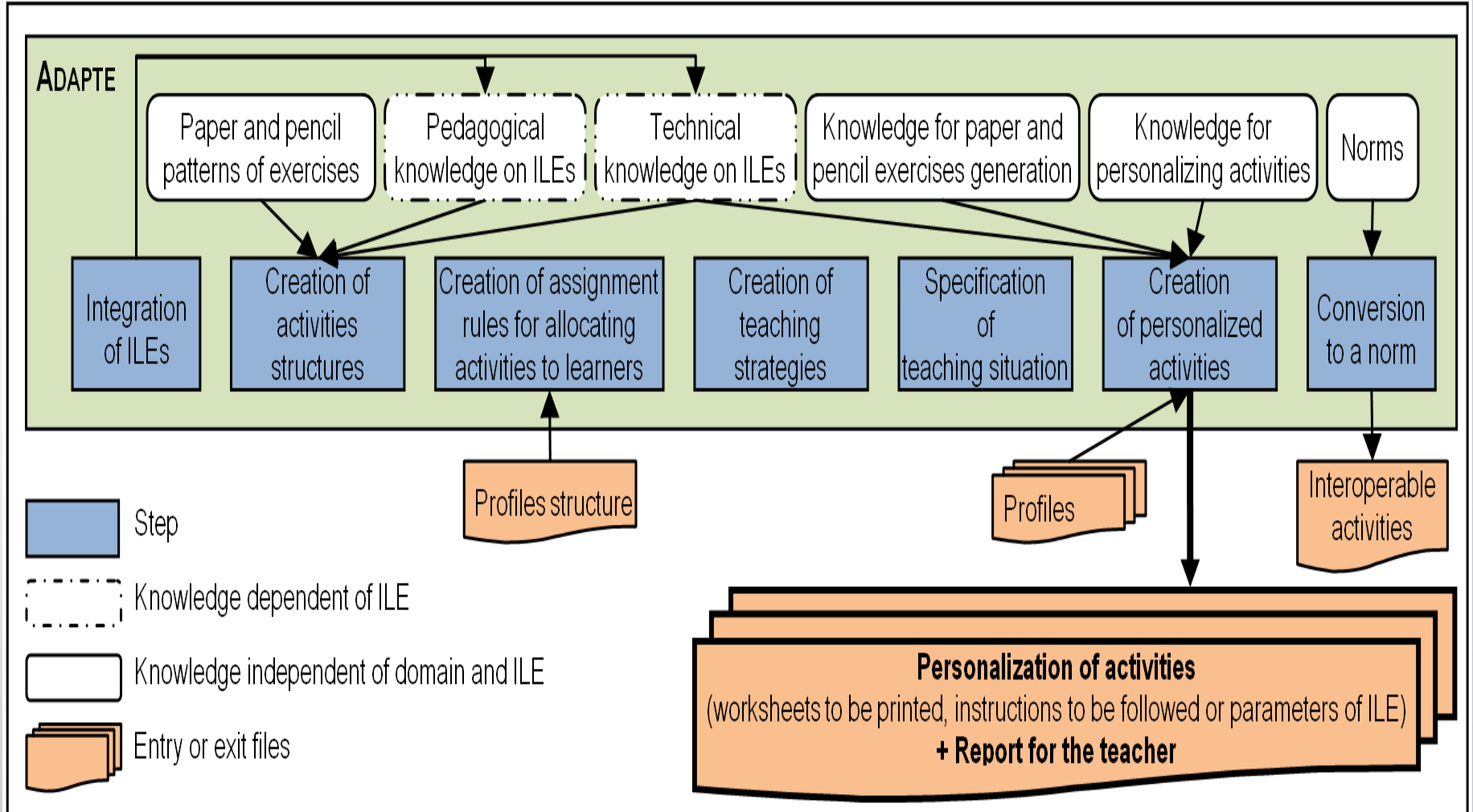
THEORETICAL & TECHNICAL NEEDS OF ADAPTE

- Mechanism to apply teaching strategies to learners profile
 - Knowledge to evaluate the assignment rules according to each profile
 - Knowledge to create paper and pencil worksheets with generated activities
 - Knowledge to create valid sessions on ILEs
- ⇒ Knowledge independent of the domain and independent of the ILE

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MECHANISM OF ADAPTE



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KNOWLEDGE BASES

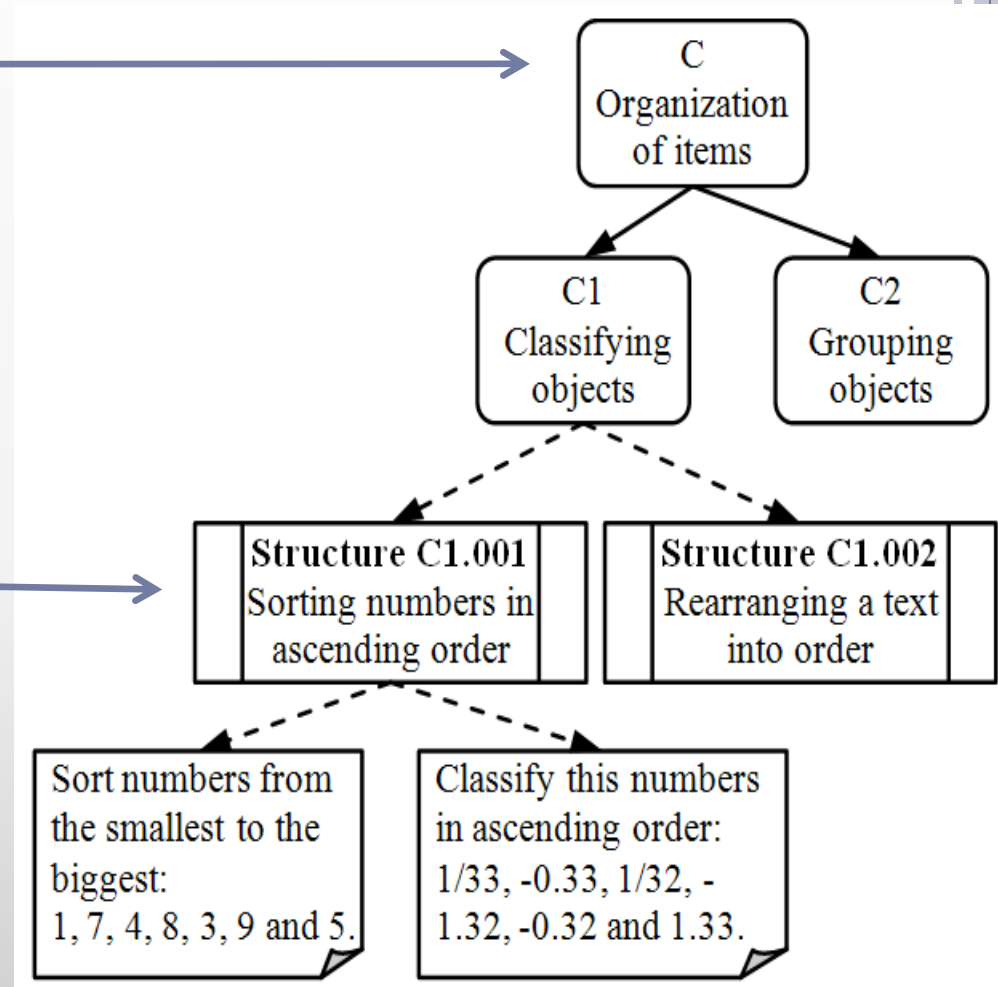
Paper and pencil exercises patterns

○ Exercises pattern

- ⇒ Theoretical definition of a category of exercises structures
- ⇒ Currently: 8 exercises pattern, independent of a domain

○ Exercises structure

- ⇒ Set of constraints to create an **exercise** of a particular type
- ⇒ Dependent of a domain



KNOWLEDGE BASES

Knowledge for paper and pencil exercises generation

- 8 semi-automatic generators
 - A semi-automatic generator creates exercises according to the constraints defined by the teacher
- Uses exercises pattern in order to know the structure of exercises
- Contains knowledge
 - Domain dependent (e.g. knowledge of calculation)
 - Domain independent (e.g. grammatical rules to generate exercises formulated in natural language)

KNOWLEDGE BASES

Pedagogical and technical knowledge on ILEs

- Knowledge dependent of the ILE and the domain
- Provided by an expert or by the designer of the ILE
- Pedagogical knowledge
 - Everything related to what is taught in the ILE
 - Parameters impacting the personalization, the associated competences, etc.
- Technical knowledge
 - How to act on the ILE to personalize it
 - Location of configuration files, available generators, exercises bases, etc.

KNOWLEDGE BASES

Knowledge for personalizing activities

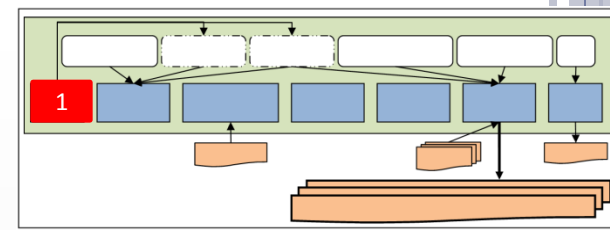
- Personalization of activities
 - Worksheet to be printed
 - Parameters enabling the personalization of an ILE
- Adapte provide
 - For each learner, a personalization of activities
 - For the teacher, a report indicating what is proposed to his learner
- Knowledge for personalizing activities
 - Rules used to assemble paper and pencil exercises in order to create worksheets
 - Rules used to create valid personalized sessions on an ILE
- Knowledge is domain independent and ILE independent

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STEPS OF PROCESS

Integration of ILEs

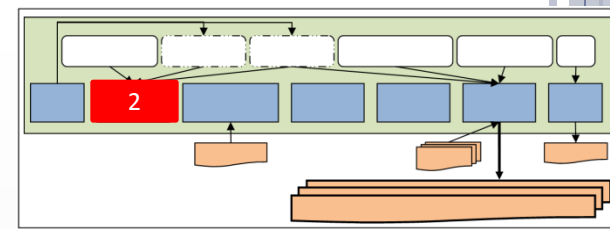


- Performed by an expert or by the designer of the ILE
- Statement of the necessary technical and pedagogical knowledge for each ILE
- Compulsory so that Adaptive can personalize an ILE
- Only done once

STEPS OF PROCESS

Creation of activities structures

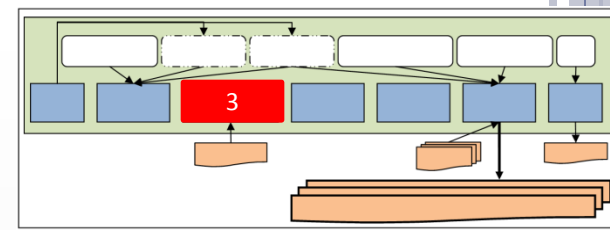
- Performed by the teacher
- In order to define exercises corresponding to his working habits
- Paper and pencil activities
 - The teacher chooses an exercises pattern
 - He defines his own generation constraints
- Personalization of a specific ILE
 - If the ILE contains a generator, the teacher define the constraints of exercises generation
 - If not, the teacher defines the constraints to select an exercise in the system database



Activities structure
"D14 - Put cities in France"

- **Exercises pattern** = Work on illustration
- **Constraints** =
 - **Illustration** = a map of France
 - **Fields** =
 - Content = cities of France
 - Quantity = 10
 - Compulsory = Paris, Lyon, Marseille
 - **Action** = to be filled

STEPS OF PROCESS. Creation of assignment rules for allocation of activities to learners



- Performed by the teacher
- In order to link parts of learners profiles to activities structures
- Parts of learners profiles
 - Selection of one or more element(s) of profile
 - Constraint these elements
 - In order to select students with particular problems or competences

Rule 1

Lack of mastery of additive word problems

- **Knowledge:** Mathematics – Exploitation of numeric data – Additive word problems
- **Values:** X between 0% and 30%
- **Activities structure:** H7 – Additive word problems – Low level

Rule 2

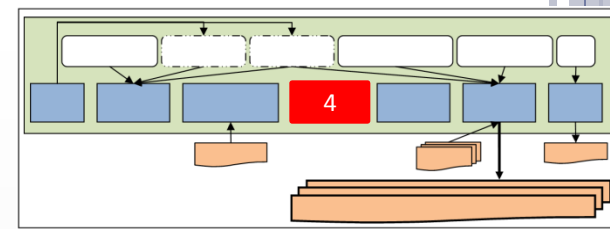
Partial mastery of additive word problems

- **Knowledge:** Mathematics – Exploitation of numeric data – Additive word problems
- **Values:** X between 30% and 70%
- **Activities structure:** H8 – Additive word problems - Hard level

STEPS OF PROCESS

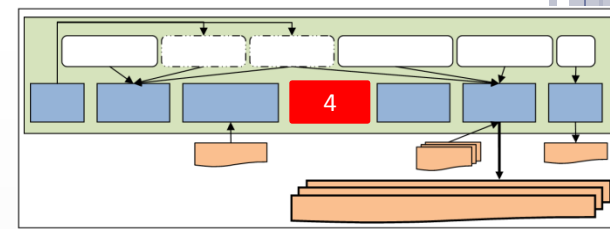
Creation of teaching strategies

- Performed by the teacher
- In order to
 - Choose the assignment rules he wishes to use
 - Classify these rules by giving them a level of importance
- Level of importance
 - Used when the system cannot choose between two exercises to provide to the learner
 - As a priority, the system will provide activities associated to the rule with the highest level of importance



STEPS OF PROCESS

Creation of teaching strategies



Creation of a teaching strategy

Creation of a teaching strategy Specification of the educational situation Generation of personalized activities

Profiles frame " Evaluations CE2 " located: ".\Fichiers utilisateur\Strategie pedagogique\Evaluations_CE2.str" Open...

Detail of the brick List : " Geography "

- France
 - Its location on a map
 - Its main cities
- Countries of the world
- Oceans
- Continents

Brick wall of the frame

Assignment rules for this profiles frame:

New Rule...

Mastery of additive word problems

New rule

Name: Importance: ← Importance

Define a new constraint for this rule...

ID	Element of profile	Operation	Concerned values
C1	Mathematics > Exploitation of numeric da		[50.. 100] ← Constraints on profile

IF:

THEN:

H102_Additive_word_problems_Hard_level.PB ← Activities structures

ELSE:

Geography French Mathematics

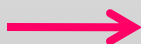
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Importance

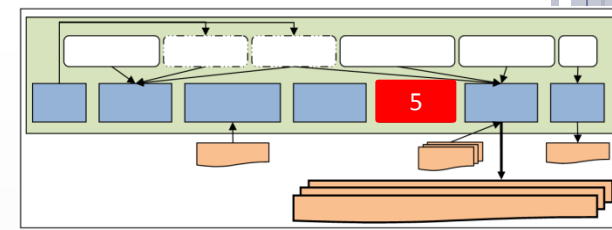
Constraints on profile

Activities structures

Learner profile



STEPS OF PROCESS. Specification of the teaching situation



- Performed by the teacher
- Specification of the learners profiles
- Definition of the general constraints enabling to “limit” the worksheets or the ILE sessions
- Definition of the specific constraints to particular learners

Definition of the global and personal criteria

Creation of assignment criteria for allocating exercises to learners Specification of the teaching situation Creation of activities personalization

Choice of the global constraints:

- Min. number of exercises for the exercises sheet: 3
- Max. number of exercises for the exercises sheet: 1
- Min. duration for the exercises sheet: 5 in minute
- Max. duration for the exercises sheet: 30 in minute
- Give a different exercise for each student.

Learner(s) profile(s)... Groupe profile...

Global constraints are modifiable for each learner:

Prenom	Nom	File	Min. number	Max. number	Min. duration	Max. duration
Alain		60_Alain_2007_09_24.XML	3	5		30
Annaelle		60_Annaelle_2007_07_04.XML	5			30
Arthur		60_Arthur_2007_07_04.XML	3	5		30
Benoit		60_Benoit_2007_09_24.xml	3	3		
Chloe		60_Chloe_2007_09_26.xml	3		15	30
Cindy		60_Cindy_2007_07_04.XML	3			30
Clelia		60_Clelia_2007_07_04.XML				
Clemence		60_Clemence_2007_07_04.XML				
Damien		60_Damien_2007_09_26.xml	3			30
Dylan		60_Dylan_2007_07_04.XML	2			30
Eddy		60_Eddy_2007_07_04.XML	3		20	
Eleonore		60_Eleonore_2007_07_04.xml	3			30
Frédérique		60_Frédérique_2007_07_04.XML	3			30
Guillaume		60_Guillaume_2007_09_26.XML	3			30
Hugo		60_Hugo_2007_07_04.XML				30
Isabelle		60_Isabelle_2007_09_26.xml	3			30
Jordan		60_Jordan_2007_07_04.XML	3			30
Jules		60_Jules_2007_07_04.XML	3			30
Julien		60_Julien_2007_09_26.xml	3			30

? Help X Back to main menu << Previous step Next step >>

General constraints

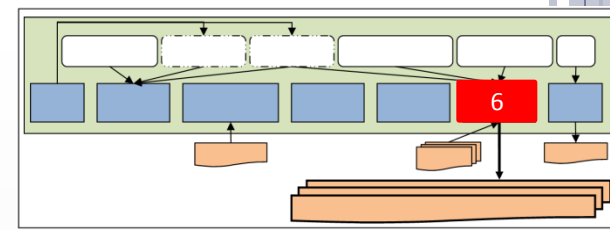
Learners profiles

Specific constraints

STEPS OF PROCESS

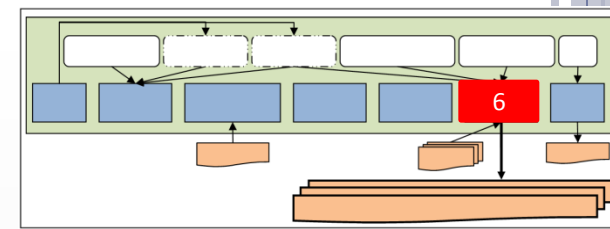
Creation of personalized activities

- Performed by the system
- Creation according to
 - Learners profiles
 - Teaching strategies defined by the teacher
 - Knowledge related to the creation of paper and pencil worksheets
 - Knowledge related to the creation of sessions on an ILE
- The selection of personalized activities is proposed to the teacher for validation or modification



STEPS OF PROCESS

Creation of personalized activities



Generation of personalized exercises sheets

Creation of assignment criteria for allocating exercises to learners | Specification of the teaching situation | Creation of activities personalization

< [Icons of 20 people] > ← List of learners

Mathilde

F91_Conjug_TAB	
Wording: Conjugate the following verbs for the given tense and person: Tense: indicative present. Person: 1st, 2nd, 3rd singular persons Verbs: to eat, to play, to dance, to have, to become.	to eat : I eat, you eat, he eats to play : I play, you play, he plays to dance : I dance, you dance, he dances to have : I have, you have, he has to become : I become, you become, he becomes
F90_Conjug_SJD_TAB	
Wording: Conjugate the following verbs for the given tense and person: Tense: indicative present. Person: 1st, 2nd, 3rd singular persons Verbs: to eat, to play, to dance, to have, to drink.	to eat : I eat, you eat, he eats to play : I play, you play, he plays to dance : I dance, you dance, he dances to have : I have, you have, he has to drink : I drink, you drink, he drinks
H103_AWP_PB	
Wording: John is at school with Paul. Before playtime, he had thirty-five marbles. Now he has forty. How many marbles did he win or receive from John.	Solution: John won 5 marbles.

Mathilde's worksheet

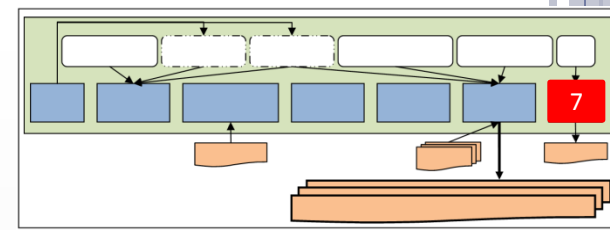
Delete OK All

Help Back to main menu << Previous step Finish

STEPS OF PROCESS

Conversion to a pedagogical norm

- Optional step
- To enable to convert paper and pencil exercises, generated by Adapte, into a given norm.
- Aims: enable exchanges with other systems.



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CONCLUSION

Evaluation issues

- Validation of the internal process of the module
 - Re-generation of existing worksheets
 - Configure five new ILEs that were not part of the initial study
- Experimentations
 - Deployment of Adapte and the full EPROFILEA environment in the context of a classroom

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