



Adaptive Learning Environments Based on IRT: Possibilities and Challenges

Kelly Wauters, Piet Desmet and Wim Van den Noortgate

Outline

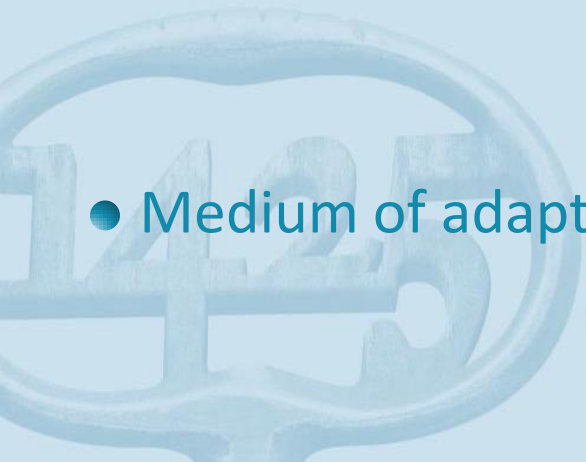
- Adaptive e-learning environments
- IRT in learning environments
 - Motive
 - Item difficulty
 - Learner's ability
 - Item selection algorithm
- Conclusion

Adaptive e-learning environments



Adaptive e-learning environments

- Form of adaptivity:
- Source of adaptivity:
- Medium of adaptivity:



Adaptive e-learning environments

- Form of adaptivity:

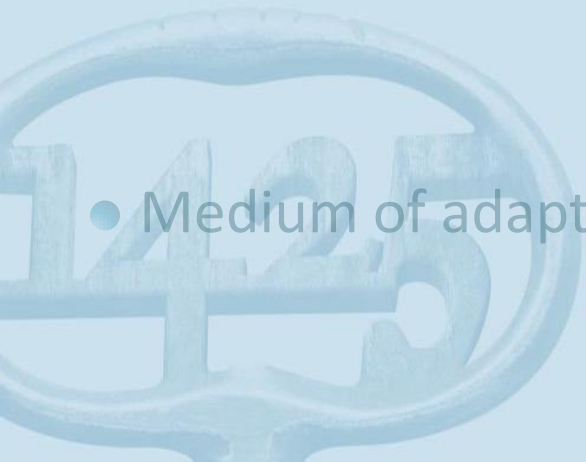
 - Adaptive form representation (pictures, videos, hyperlinks,...)

 - Adaptive content representation (intelligent help, discover misconceptions,...)

 - Adaptive curriculum sequencing (dynamic selection of optimal item for each learner)

- Source of adaptivity:

- Medium of adaptivity:



Adaptive e-learning environments

- Form of adaptivity:

 - Adaptive form representation

 - Adaptive content representation

 - Adaptive curriculum sequencing

- Source of adaptivity:

 - Course/item features (difficulty level, topic, ...)

 - Person features (ability level, cognitive load, interests,...)

 - Context features (device, time, location,...)

- Medium of adaptivity:

Adaptive e-learning environments

- Form of adaptivity:

 - Adaptive form representation

 - Adaptive content representation

 - Adaptive curriculum sequencing

- Source of adaptivity:

 - Course/item features

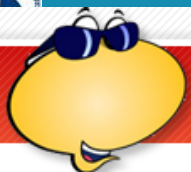
 - Person features

 - Context features

- Medium of adaptivity:

 - Task-based (e.g. ASSISTment [1])

 - Item-based (e.g. Franel [2])



Un été à la campagne - B2

Préparation à l'écoute

PE1

PE2

PE3

Compréhension globale

Compréhension détaillée

Thème lexical: Création d'un logeme

Thème grammatical: L'accord du pa

Orthographe- Prononciation

Actes de langage: Faire une réserv

Activités complémentaires

Un été à la campagne - B2 > Préparation à l'écoute > PE1

Cochez la bonne réponse.

Voici le logo de 'Gîtes de France'. Cette organisation:



- regroupe tous les hébergements de vacances à la campagne en France.
- accueille des jeunes en difficulté.
- construit des maisons modestes pour des familles nombreuses françaises.
- regroupe toutes sortes de logements qui accueillent des touristes en France.
- regroupe toutes les agences immobilières en France.

Adaptive learning environments

- Form of adaptivity:

 - Adaptive form representation

 - Adaptive content representation

 - Adaptive curriculum sequencing

- Source of adaptivity:

 - Course/item features

 - Person features

 - Context features

- Medium of adaptivity:

 - Task-based

 - Item-based

Adaptive curriculum sequencing in item-based learning environments by matching the item difficulty level to the learner's ability level

Adaptive learning environments

- Form of adaptivity:

Adaptive form representation

Adaptive content representation

Adaptive curriculum sequencing

- Source of adaptivity:

Course/item features

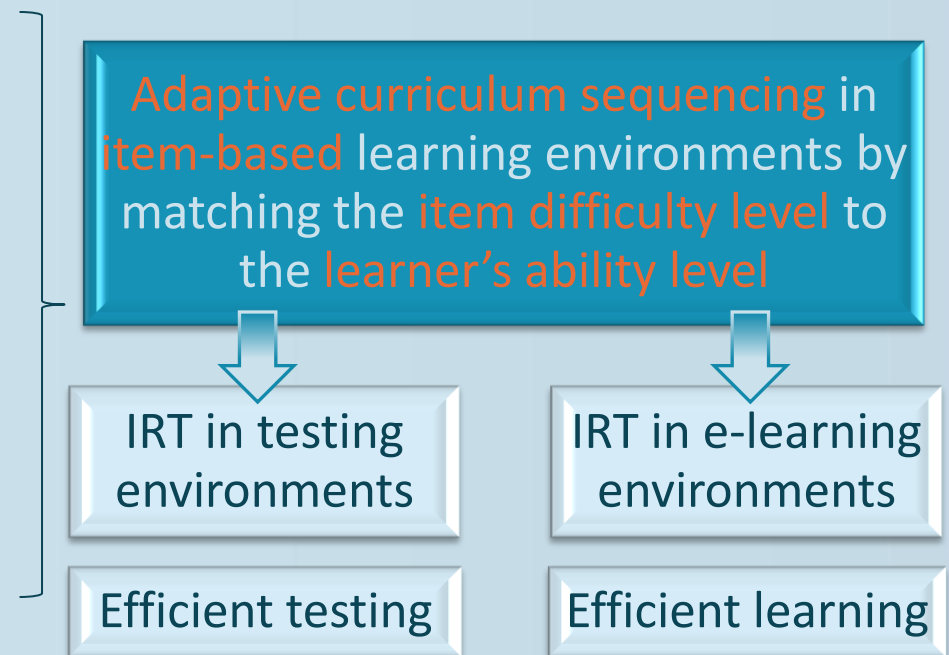
Person features

Context features

- Medium of adaptivity:

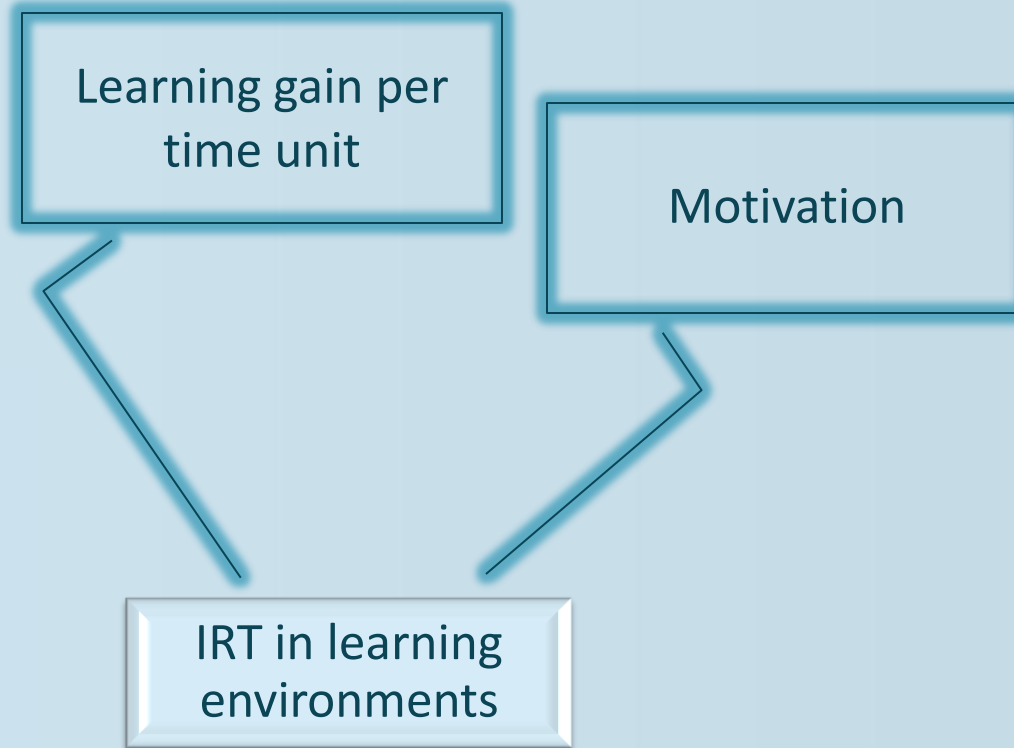
Task-based

Item-based



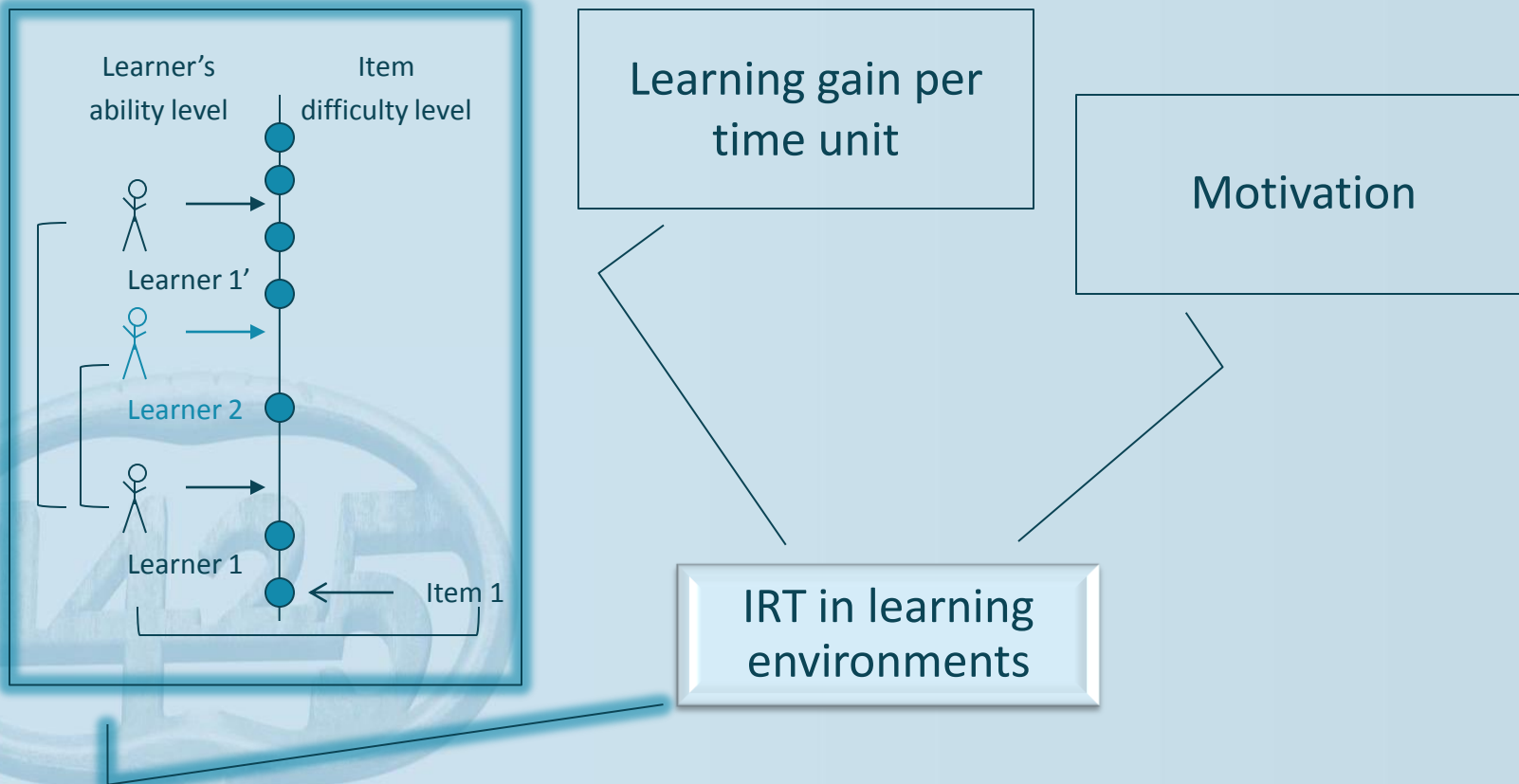
IRT in learning environments

Extrapolation of the ideas of IRT and CAT to learning environments



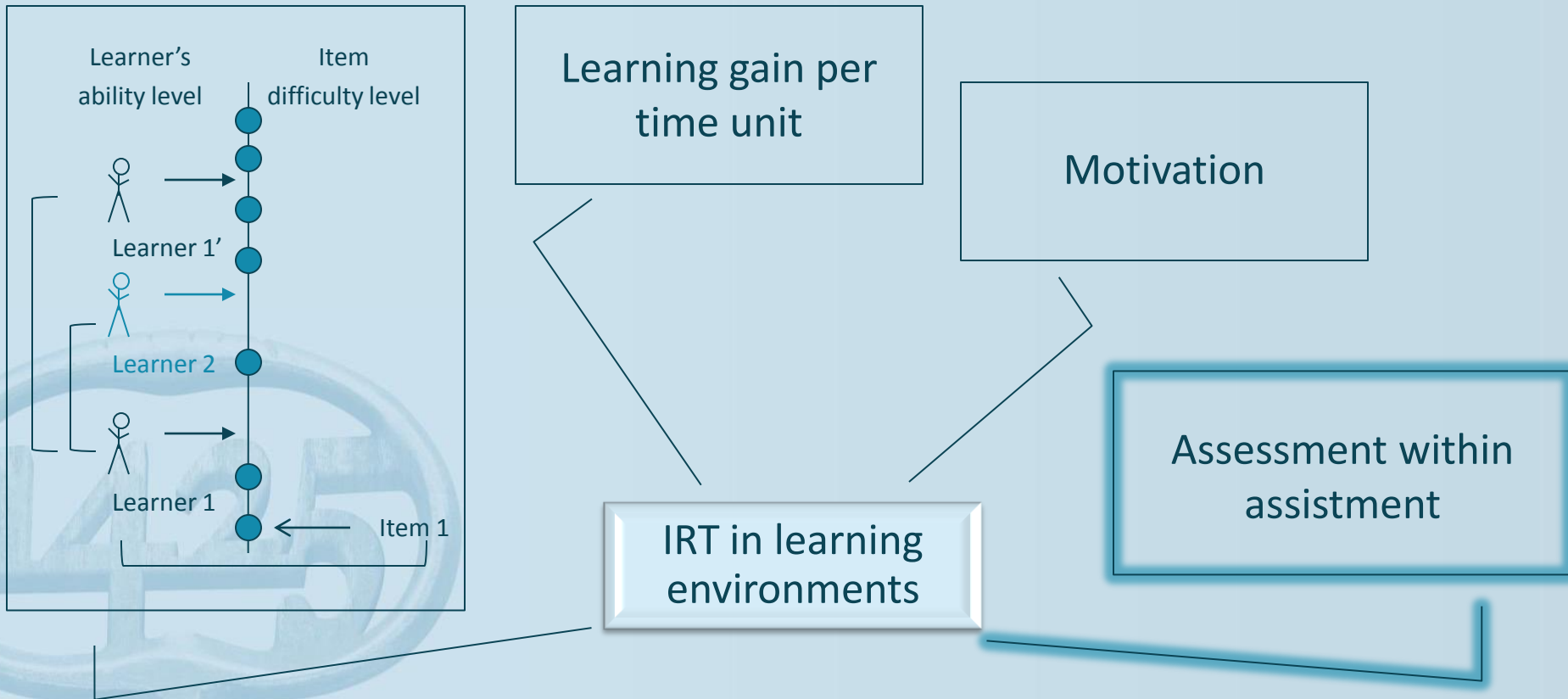
IRT in learning environments

Extrapolation of the ideas of IRT and CAT to learning environments



IRT in learning environments

Extrapolation of the ideas of IRT and CAT to learning environments



IRT in learning environments

Feasible?



Item difficulty estimation

- Existing learning environments:

- Proportion correct

- Learner's feedback ("How difficult did you find this item?")

- Expert rating ("What is the percentage of learners who will answer this item correct?")

- Paired comparison



Item difficulty estimation

- Why not based on IRT calibration?

Item-based learning environments: Franel/BLCC/De post



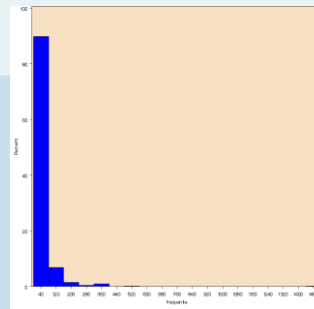
Item difficulty estimation

- Why not based on IRT calibration?

Item-based learning environments: Franel/BLCC/De post

Missing values

○ Administration frequency



○ 30000 items

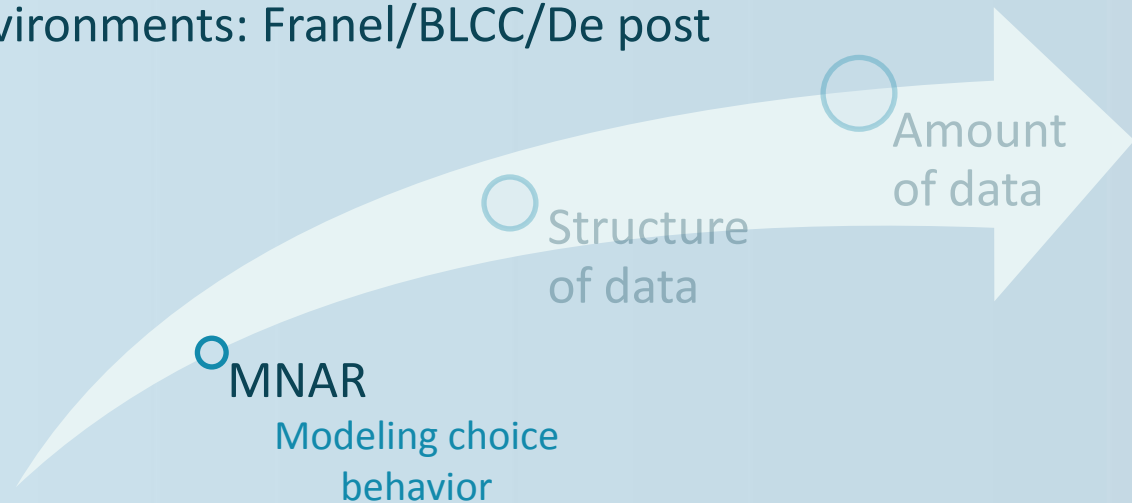
○ Learner's freedom

Item difficulty estimation

- Why not based on IRT calibration?

Item-based learning environments: Franel/BLCC/De post

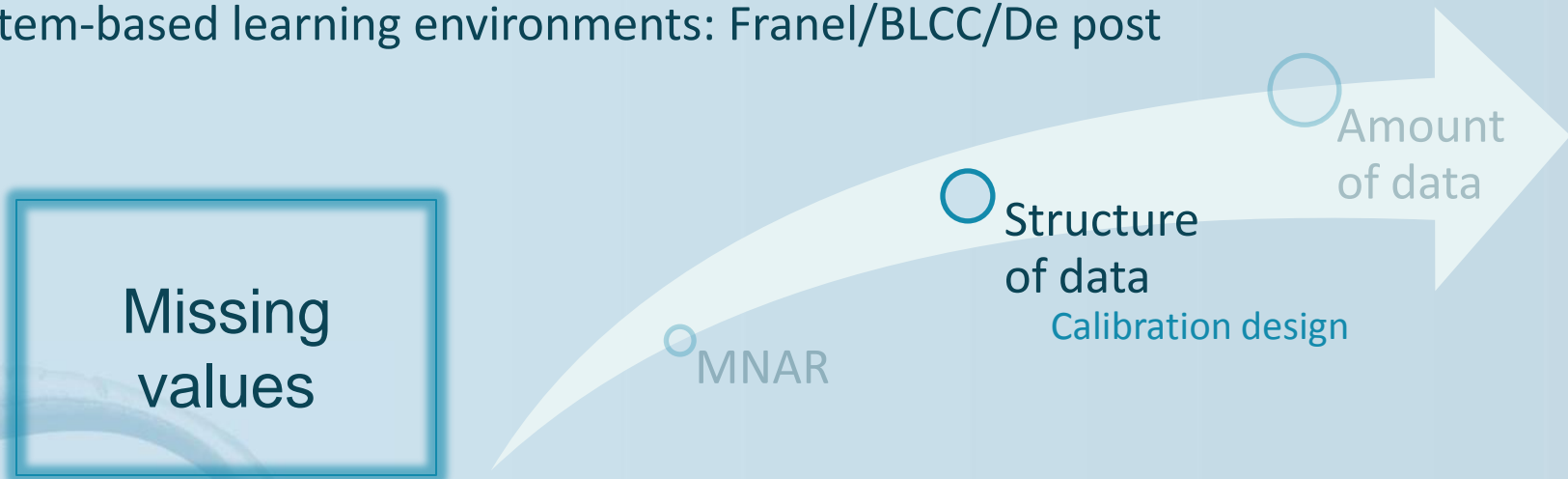
Missing values



Item difficulty estimation

- Why not based on IRT calibration?

Item-based learning environments: Franel/BLCC/De post

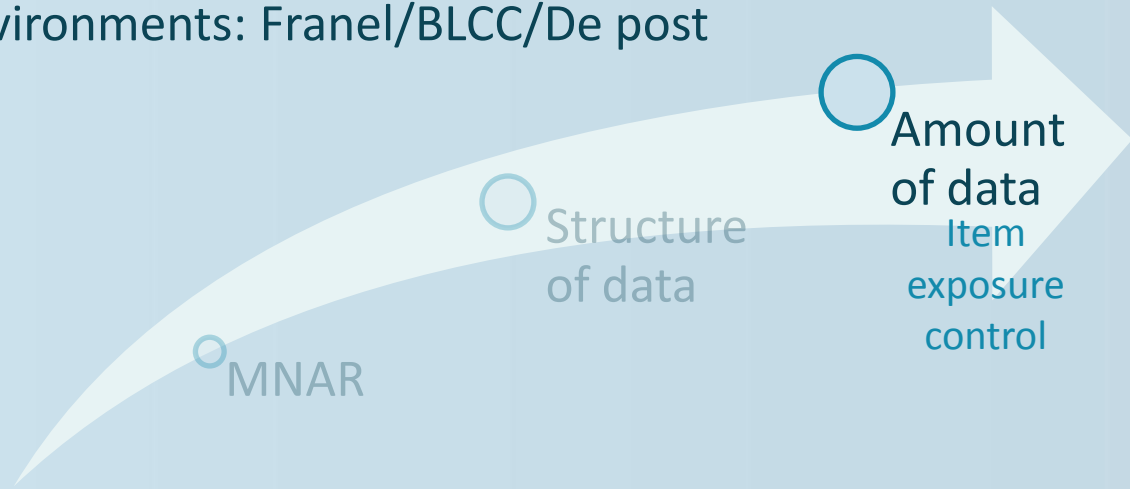


Item difficulty estimation

- Why not based on IRT calibration?

Item-based learning environments: Franel/BLCC/De post

Missing values



Learner's ability estimation

- Cold start problem
Group adaptation

- Change in ability level
Knowledge gain/loss



Item selection algorithm

- Objective

 - Optimize learning efficiency

- Means

 - Item difficulty level (difficult, moderate, easy)

 - Learner's control (shared control)



Conclusion

- IRT in learning environments?

Yes, but...

adaptation of the existing algorithms

combination of existing methods

Further research in progress



Thank you!
Questions and suggestions

Contact

Kelly.Wauters@kuleuven-kortrijk.be

Wim.VandenNoortgate@kuleuven-kortrijk.be

www.kuleuven-kortrijk.be/itec

References

- [1] Razzaq, L., Feng, M., Nuzzo-Jones, G., Heffernan, N.T., Koedinger, K.R., Junker, B. et al. (2005). The Assistment Project: Blending Assessment and Assisting. In C.K. Looi, G. McCalla, B. Bredeweg & J. Breuker (Eds.), *Proceedings of the 12th International Conference on Artificial Intelligence in Education* (pp. 555-562). Amsterdam: ISO Press.
- [2] Desmet, P. (2006). L'apprentissage/enseignement des langues à l'ère du numérique: tendances récentes et défis. *Revue française de linguistique appliquée*, 11, 119-138.

