Year Report of the Institute of Medical Education Research Rotterdam (iMERR) 2018

iMERR aims to improve the selection and education of a new generation of doctors through educational research

Prof. Dr. W.W. van den Broek, director of Medical Education Erasmus MC

Key words: medical education, continuing medical education, admission test college, clinical clerkship, internship and residency, problem-based learning, e-learning, instructional design, game-based learning, self-regulated learning, clinical reasoning, minority recruitment.

Scientific Publications in International Journals

1. Alqahtani, D.A., Rotgans, J., Mamede, S., Mahzari, M.M., Al-Ghamdi, G.A. & Schmidt, H.G. (2018). Factors underlying suboptimal diagnostic performance in physicians under time pressure. Medical Education, 52 (12), 1288-1298. doi: 10.1111/medu.13686

2. Andel, C.E.E. van, Born, M., Themmen, A.P.N. & Stegers-Jager, K.M.(2018). Broadly sampled assessment reduces ethnicity-related differences in clinical grades. Medical Education, in press. doi: 10.1111/medu.13790

3. Stegers-Jager, K.M.(2018). Lessons learned from 15 years of non-grades-based selection for medical school. Medical Education, 52 (1), 86-95. doi: 10.1111/medu.13462

4. Kickert, R., Stegers-Jager, K.M., Meeuwisse, M., Prinzie, P. & Arends, L.R. (2018). The role of the assessment policy in the relation between learning and performance. Medical Education, 52 (3), 324-335. doi: 10.1111/medu.13487

5. Kickert, R., Stegers-Jager, K.M., Meeuwisse, M., Prinzie, P. & Arends, L.R. (2018). The role of the assessment policy in the relation between learning and performance. Medical Education, 52 (3), 324-335. doi: 10.1111/medu.13487

6. Leng, W.E. de, Stegers-Jager, K.M., Born,M. & Themmen, A.P.N. (2018). Influence of response instructions and response format on applicant perceptions of a Situational Judgement Test for medical school selection. BMC Medical Education, 18 (1):282. doi: 10.1186/s12909-018-1390-0

7. Leng, W.E. de, Stegers-Jager, K.M., Born, M. & Themmen, A.P.N. (2018). Integrity situational judgement test for medical school selection: judging 'what to do' versus 'what not to do'. Medical Education, 52 (4), 427-437. doi: 10.1111/medu.13498

8. Nazari, T., Vlieger, E.J., Dankbaar, M.E.W., Merrienboer, J.J.G. van, Lange, J.F. & Wiggers, T.(2018). Creation of a universal language for surgical procedures using the step-by-step framework. BJS Open, 2 (3), 151-157. doi: 10.1002/bjs5.47

9. Ribeiro, L.M.C., Mamede, S., Moura, A.S., Brito, E.M. de, Faria, R. de & Schmidt, H.G. (2018). Effect of reflection on medical students' situational interest: an experimental study. Medical Education, 52 (5), 488-496. doi: 10.1111/medu.13491

10. Rosby, L.V., Rotgans, J., Tan, G., Low-Beer, N., Mamede, S., Zwaan, L. & Schmidt, H.(2018). Inducing System-1-type diagnostic reasoning in second-year medical students within 15minutes. Medical Teacher, 40 (10), 1030-1035. doi: 10.1080/0142159x.2017.1418502

11. Rumayyan, A. Al, Ahmed, N., Subait, R. Al, Ghamdi, G. Al, Mahzari, M.M., Mohamed, T.A., Rotgans, J., Donmez, M., Mamede Studart Soares, S. & Schmidt, H.G.(2018). Teaching clinical reasoning through hypothetico-deduction is (slightly) better than self-explanation in tutorial groups: An experimental study. Perspectives on Medical Education, 7 (2), 93-99. doi: 10.1007/s40037-018-0409-x

12. Linsen, A., Elshout, G., Pols, D., Zwaan, L., Mamede, S.(2018). Education in Clinical Reasoning: An Experimental Study on Strategies to Foster Novice Medical Students' Engagement in Learning Activities. Health Professions Education, 4(2) 86-96. https://doi.org/10.1016/j.hpe.2017.03.003

13. M Sibbald, J Sherbino, JS Ilgen, L Zwaan, S Blissett, S Monteiro, Geoffrey Norman. Debiasing versus knowledge retrieval checklists to reduce diagnostic error in ECG interpretation. Advances in Health Sciences Education, 1-14, 2018

Conference proceedings and presentations

• Dankbaar, M Importance of a serious games evaluation framework for healthcare. Singapore, Serious Games Conference (October 26, 2018) at the SinghHealth Academia.

• Faber, T.J.E; Dankbaar, M.E.W.; van Merriënboer, J.J. (2018, March).'Measuring self-regulated learning in a serious game using microanalysis'. Poster at the Conference of the Dutch Society for Simulation in Healthcare (DSSH, Enschede). Winner Poster price.

• Faber, T.J.E (2018, March). 'Measuring self-regulated learning in a serious game using microanalysis' Presentation at Science Cafe APPG Radboudumc

• Faber, T.J.E.; Dankbaar, M.E.W.; van Merriënboer, J.J.(2018, July). Applying an instructional design method to serious games – experiences and lessons learned. Presentation at the International Conference on Information,

Intelligence, Systems and Applications' (IISA) in Greece

• Faber, T.J.E.; Dankbaar, M.E.W.; van Merriënboer, J.J. (2018, november). Een instructional design benadering voor serious games; ervaringen en geleerde lessen, Poster voor NVMO Congres Egmond aan Zee.

• Kickert, R., Stegers-Jager, K.M., Meeuwisse, M., Arends, L.R.& Prinzie, P. (2017, februari 21). De rol van zelfregulerend leren en participatie in het behalen van studieprestaties onder een vernieuwd toetsingssysteem. Rotterdam, Erasmus Education Research (EER) lunchmeeting.

• Kickert, R., Stegers-Jager, K.M., Meeuwisse, M., Arends, L.R. & Prinzie, P. (2017, juni 9). The role of the assessment system in the relation between learning and performance. Rotterdam, Erasmus University College, CEL innovation room.

• Kickert, R., Stegers-Jager, K.M., Meeuwisse, M., Arends, L.R. & Prinzie, P. (2017, april 25). The role of the assessment system in the relation between learning and performance. Rotterdam, Erasmus Medical Center, IMERR labmeeting.

• Mamede, S.(2018, June 25th). Clinical Reasoning: How it works and How it doesn't; Institute for Medical Education, University of Bern, Switzerland (colloquium; guest professor)

• Mamede, S.. Teaching Diagnostic Reasoning: Hints from Research on Clinical Reasoning. Inselspital University Hospital Bern, Switzerland (lecture; guest professor)

• Mamede, S.(2018, September 17). Clinical reasoning in medical diagnosis. Groningen, University Medical Centre Groningen, Educational seminar.

• Figueiredo, T., Elói, S., de Faria, R.M., van Gog, T., Schmidt, H.G , Mamede, S. Instructional approaches for the development of clinical reasoning: the effects of modeled-reflection, cued-reflection and free-reflection on students' diagnostic performance, Basel, AMEE conference 2018 (short communication)

• Forum of Quality and Safety in Healthcare (international conference), experience day at Erasmus May 2, 2018. Invited workshop 'Learning from Mistakes' Laura Zwaan and Markus Klimek

• Invited presentation: lunchmeeting at Rijnstate ziekenhuis, Arnhem. 24 mei, 2018. Diagnostic reasoning and Diagnostic Errors. Laura Zwaan

• Invited presentation during lab meeting at VA Houston/ Baylor college of Medicine (Houston, USA 25 September 2018). 'Are fast diagnoses better diagnoses?' Laura Zwaan

• Imperial college, London. Teacher of a full day course for Master of Patient Safety. 'Medical Decision Making and Diagnostic Errors'. Laura Zwaan

• NFU, Symposium 'Leren van calamiteiten' 'Identifying and Classifying Human

factors contributing to calamities' 15 November 2018, Amersfoort. Laura Zwaan

• Short course on 'The science of diagnostic error at Diagnostic Error in Medicine' (New Orleans 2018) Laura Zwaan, Hardeep Singh and Traber Giardina.

• Short course for junior researchers 'Studying diagnostic error in medicine' Bern Switzerland, August 29 2018. Laura Zwaan and Hardeep Singh.

• Sympoisum: Diagnostic error: From clinical reasoning to patient outcome Wolf Hautz, Mark grabber, Laura Zwaan, Hardeep Singh, Marie-Claude Audetat. AMEE conference in Basel, August 2018

• Oral abstract presentation: 'Learning to diagnose X-rays: Seeing many examples or receiving extensive feedback on few examples?' Laura Zwaan, Burhan Hussain, Annick Devos, Walter van den Broek, Sílvia Mamede, Henk Schmidt. Winner of the best oral abstract presentation. At the diagnostic Error in medicine conference, new Orleans, November 2018.

• Stegers-Jager KM, Savas M, Rossum EFC van, Waal J van der, Woltman AM (2018, November). Verhoging van de eis voor Bindend Studieadvies heeft een genderspecifiek effect op studieprestaties en stress bij studenten Geneeskunde. NVMO 2018 Conference, Egmond aan Zee, the Netherlands (research paper).

• Andel CEE van, Stegers-Jager KM, Themmen APN, Born PM (2018, November). Meerdere beoordelingen leiden tot minder etniciteit gerelateerde verschillen in coschapcijfers. NVMO 2018 Conference, Egmond aan Zee, the Netherlands (research paper).

• Patterson F, O'Mara D, Stegers-Jager K, Taipapaki Curtis E (2018 April). Enhancing diversity and widening access in selection for medical education. 2nd International Selection in the Health Professions Conference, Melbourne, Australia. (Symposium)

• Lokke Gennissen. Organic or Organised? Decision-making process for residency selection. 2nd International Selection in the Health Professions Conference, Melbourne, Australia.(Research paper)

• Invited presentation: Seeing the black box differently. Kunnen wij hetzelfde (leren) zien? Opleidings- en onderwijsmiddag Dermatologie, Erasmus MC. June 21st 2018. Karen Stegers-Jager

• Invited presentation: De black box verschillend 'zien': assessor cognitieve vanuit drie perspectieven. Onderwijsmiddag Master geneeskunde, Erasmus MC. March 8th 2018. Karen Stegers-Jager

Grants

Moore foundation: $ 175.000

HGOG: 300.000 euro

Ongoing PhD trajectories within the EUR

Learning from diagnostic mistakes that resulted in a liability claim, Charlotte van Sassen, MD.

Charlotte van Sassen started her PhD project in 2018 under supervision of Pieter van den Berg, MD, PhD, Laura Zwaan, PhD, Prof. Walter van den Broek, MD, PhD and Prof. Patrick Bindels, MD, PhD. Her project focuses on learning from diagnostic mistakes that resulted in a liability claim.

Learning from mistakes is considered to be important in healthcare. What makes learning from errors special? Is it just that they reflect domain-specific content that is generally not well understood and thus error-prone, or is there more to it? The fundamental question of the project is: Are errors particularly suitable for learning or can we just as well learn from successes?

The project exists of several studies. In Study 1 we will identify important knowledge gaps of trainees by analyzing GPs' malpractice claims. We will make use of the malpractice claim database of the VvAA, the largest liability insurance company of GPs in the Netherlands.

Secondly, two experimental studies will be conducted to determine whether knowing that a clinical case resulted in a malpractice claim facilitates learning (Study 2) and to examine how the role of information processing by which information about a case (i.e. patient specific or clinical information) is better remembered (Study 3).

Lastly in Study 4, we will study the influence of hindsight bias (i.e. how knowing the outcome alters the evaluation of the process) in assessment of vocational training.

With the studies we aim to contribute to novel evidence-based learning from mistakes in an educational setting and contribute to improving diagnostic accuracy in general practice.

Examining the cognitive causes of errors in diagnostic reasoning, Justine Staal, MSc.

Justine started her PhD in June 2018 under the supervision of Laura Zwaan, PhD Jelmer Alsma, MD, Prof. dr. Maarten Frens, and Prof. dr. Walter van den

Broek. Her PhD-project focusses on examining the cognitive causes of errors in diagnostic reasoning.

Diagnostic errors are a serious patient safety concern but have received little attention in the field of patient safety. A 2015 report from the National Academy of Medicine (NAM) 'Improving Diagnosis in Health Care' has drawn attention to the topic. The report highlights the prevalence and impact of diagnostic errors and calls for action to improve the diagnostic process.

Central to this effort is better understanding what causes diagnostic errors. Cognitive factors that would arise during fast, automatic reasoning (e.g. biases – systematic reasoning errors due to a failure to consider all information), are considered the major contributing factor and they are therefore currently seen as a leading cause of diagnostic error. However, recent publications argue that cognitive biases may not be the main cause of diagnostic error and that the full extent and impact of these biases is still unknown.

To further examine the causes of diagnostic errors, Justine's first and second study will focus on how fast reasoning and selectivity in information processing relate to cognitive biases and diagnostic errors, as both are seen as underlying causes of bias, and therefore, of error. Justine started the first study with medical residents, which will be conducted at the Erasmus MC, Amsterdam UMC, and in Minnesota. Based on these results, the second study will be improved and conducted. Information processing during diagnosis will be measured in this study, using an eye-tracker.

Situational Judgment Test (SJT) for the Selection into Medical School, Wendy de Leng, MsC.

Wendy started her PhD in April 2014 under the supervision of dr. Karen Stegers-Jager (co-promotor), prof. dr. Axel Themmen (1st promotor) and prof. dr. Marise Born (2nd promotor). Her PhD-project is focused on selection into medical school using a Situational Judgment Test (SJT).

During the selection procedure of last year a first SJT originating from the UK was administered among the applicants for the Erasmus Medical School. This SJT, created to measure integrity, aims at extending the range of constructs on which medical students are selected. In addition, an SJT displays lower ethnic subgroup differences that exist on traditional cognitive tests and can thereby increase the ethnic diversity among medical students.

The SJT was administered among a group of Subject Matter Experts (SMEs) in order to create a rational scoring key for converting the applicants' judgments into scores. Several of these rational scoring methods exist. Wendy's first study will be focused on the comparison of these different scoring methods on the reliability of and ethnic subgroup differences on the SJT. Because of the overall low reliability of the integrity SJT as well as concerns with the realism of some of the scenarios, Wendy started with the development of a new SJT using critical incident interviews. New scenarios will be written based on these

critical incidents. This new SJT will be administered during the next selection procedure.

Recruitment and selection for a future diverse medical workforce, Lokke Gennissen, MD.

Lokke Gennissen started her PhD in July 2014, under supervision by dr. Karen Stegers-Jager, prof. dr. Matthijs de Hoog (Erasmus Medical Center), dr. Lia Fluit and prof. dr. Jacqueline de Graaf (Radboud University Medical Center Nijmegen).

In order to make a more fluent transition from undergraduate to postgraduate medical training and in that way pursuing an educational continuum a fast track program is introduced in the Netherlands. The fast track program is a program for last year medical students, where they can already acquire competencies at the level of first year residents in training in their specialty of choice. These acquired competencies enable a reduction of the duration of postgraduate training.

In the context of these recent changes this PhD trajectory is focused on the specialism choice of medical students and the recruitment and selection of the future medical specialists. These recent changes confront students and (postgraduate) educators with an earlier decision moment. Students are confronted with an earlier specialism choice, while postgraduate educators are confronted with an earlier selection of students eligible for postgraduate training in their specialty.

To address the lack of diversity in the medical specialty population, the focus in the studies concerning the specialism choice will be on the role of ethnicity, socio-economic class and gender. In her first study she will interview both selection committee members and applicants regarding the selection of residents.

In a second study she will look into prestige perception differences of medical specialties between Dutch and ethnic minority medical students and between first generation and not first generation university students.

Does ethnic bias in rater-scores differ across clerkships?, Chantal van Andel, MsC.

Chantal started her PhD in January 2017 under supervision of dr. Karen Stegers-Jager (co-promotor), prof. dr. Walter van den Broek (1st promotor) and prof. dr. Marise Born (2nd promotor). Her PhD-project aims to contribute to a more inclusive medical education setting, for instance by investigating curriculum changes, assessment methods and assessor bias.

This research is relevant given the societal benefits of a diverse medical workforce. Previous research at Erasmus MC Medical School has shown that ethnic majority students are more likely to receive higher grades as compared to ethnic minority students during their clerkships. A potential explanation for

this can be found in subjectivity of clinical ratings, yet interventions to reduce unwanted sources of bias have been largely unsuccessful.

A broadly sampled assessment implies mixed assessments used by various assessors across multiple moments. This type of assessment is expected to reduce unwarranted variances, and could thereby mitigate ethnic disparities in clinical grades. This has been investigated and is reported in her first, recently published, paper. Her second paper will not focus on evaluation systems (global versus broadly sampled), but on scoring forms. Is an assessment tool such as a global rating scale (GRSs) more susceptible to ethnic bias as compared to a checklist?

GRSs and checklists are widely used assessment tools and both have their strengths and weaknesses. A weakness of the GRS, as opposed to a checklist, is that it is more susceptible for quick, first impressions. occur when a GRS is being used (as compared to a checklist).

This study will also test whether rater confidence (the extent to which a rater beliefs he/she made an accurate judgment) is associated with students' ethnicities and the assessment tool (GRS versus checklist) being used. Her third paper will investigate perceptions of unfair treatment and whether these are related to self-regulation, perception of educational culture and trust in raters.

Using real-time cognitive and non-cognitive indicators for regulation and self-regulation in game-based learning, Tjitske Faber, MD.

Tjitske started her PhD in september 2017, under supervision by dr. Mary Dankbaar, prof. dr. Walter van den Broek (Erasmus MC Medical Center), dr. Jeroen Donkers and prof. dr. Jeroen van Marrienboer (Maastricht University). Het PhD project focuses on finding indicators for learning professional and self-regulatory learning skills in serious games.

Serious games have the potential to teach complex cognitive skills in an engaging and flexible way. They often provide real-time feedback based on cognitive performance indicators. Measurement of non-cognitive (eye-movements, stress) and cognitive (cognitive load, game-data) process indicators might generate important information on learning processes, which can be used to improve the development of professional and self-regulated skills, using adaptive (computer-regulated) or self-regulated learning. Self-regulated skills are important 21st-century skills to enable continuous learning.

Caring for acutely ill patient is a demanding task that combines medical knowledge with procedural and non-technical skills. For the inexperienced young doctor or medical student, the task can be daunting. Proficiency in skills is often directly related to patient safety. Games have the potential to teach complex cognitive skills in an engaging, flexible and patient-safe way. The Erasmus University MC developed a simulation game to train these complex cognitive skills: the abcdeSIM.

Previous research showed that incorporating this game in training is effective for doctors, but not for medical students. Students show high motivation and high cognitive load playing the game, however they do not spend more time studying. A potential explanation is that students are not able to self-regulate their learning effectively.

In this research, we will investigate cognitive and non-cognitive process indicators which can generate information on learning processes, such as stress measurements and tracing of in-game behaviour. This information can be used to improve the development of professional and self-regulated skills, using adaptive (computer-regulated) or self-regulated learning.

We will expand and redesign the game, exploring how the use of process indicators can improve learning. This redesign was done according to the design principles of the 4C/ID (4 Components/Instructional Design) Model of van Merrienboer, implementing complexity levels, more cases, online guidance and feedback. A model to analyze game-data and eye-tracking data was designed. Based on a literature review, a method to measure self-regulated learning was designed (using micro-analysis), piloted and used in a study. We will analyse how use of game-data can help learning professional and self-regulated learning skills.

The influence of debriefing sessions guided by indicator's information will be explored. Finally, we will compare the effects of adaptive versus self-regulated learning in the game on learning professional and self-regulated skills in the short and long-term.

Teaching Reflection Through Modelling As A Strategy To Counteract Diagnostic Mistakes In General Practice, Josepha Kuhn, MsC.

Josepha Kuhn started her PhD in 2016 under the supervision of prof. dr Patrick Bindels (Department of General Practice, ErasmusMC), prof. dr. Tamara van Gog (Utrecht University) and the co-supervision of dr. Silvia Mamede (iMERR) and dr. Pieter van den Berg (Department of General Practice, ErasmusMC).

Her project explores ways to teach reflection as an approach to prevent possible flaws in diagnostic reasoning of general practitioners. In a series of experiments and one quasi-experimental study with general practice residents, the project will (1) explore whether reflective reasoning can be taught, (2) compare the effectiveness of different instructional approaches for teaching reflective reasoning, and (3) investigate the effectiveness of the instructional approach by implementing it in the actual curriculum of the general practice training in the Erasmus MC.

Collaboration with department of Rheumatology, Laura Kranenburg-van Koppen, MD.

Under the supervision of prof.dr. Mieke Hazes and prof. dr. Walter van den Broek (promoter) and dr. Mary Dankbaar (co-promotor). Laura Kranenburg- van

Koppen is working on her PhD in the role of E-Learning for residents. She has done studies on the possibilities of e-consultation and e-information to improve self-management by patients and the functions of an e-learning portal for clinicians, and an evaluation of the training in shared decision making and other communication strategies for residents Reumatology.

Collaboration with the Faculty of Social Sciences, Erasmus University Rotterdam, Rob Kickert ,MsC.

Dr. Karen Stegers-Jager together with prof.dr. Peter Prinzie, prof.dr. Lidia Arends & dr. Marieke Meeuwisse (all EUR)), expected early 2020. Thesis theme: Academic performance, behavior and student characteristics under a renewed examination system.

Ongoing PhD trajectories outside the EUR

The following external PhD projects have been ongoing, under the supervision of Prof.dr. Henk Schmidt, with dr. Sílvia Mamede as co-supervisor:

- Dalal Al Qahtani, dentist, Medical College, King Saud bin Abdul-Aziz University for Health Sciences, Riyadh, Saudi Arabia. Thesis theme: Contextual factors influencing physicians' diagnostic performance.

- Elmi Badenhorst, psychologist, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa. Theme of the thesis: Students' misconceptions in medical education

- Telma Kremer, psychologist, University of São Paulo, São Paulo, Brazil. Thesis theme: Students' emotions and learning in medical education.

- Shaikha Hamed Al-Aujan, dentist, King Saud bin Abdul-Aziz University for Health Sciences, Riyadh, Saudi Arabia. Thesis theme: Expertise in clinical reasoning in dentistry

- Lucy Victoria Rosby, medical doctor, Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore. Thesis theme: In search of System 1 versus System 2.

- Daniel Franci, medical doctor, Faculty of Medicine, UNICAMP, Brazil. Thesis theme: Multimedia learning in medical education: Point-of-care ultrasound in the teaching of clinical reasoning

- Ligia Cayres Ribeiro, internist, Medical College, UNIFENAS, Belo Horizonte, Brazil. Thesis theme: The influence of reflection upon clinical experiences on medical students' learning process and outcomes.

- Ahmed Al Rumayyan, medical doctor, Medical College, King Saud bin Abdul-Aziz University for Health Sciences, Riyadh, Saudi Arabia. Thesis theme: Theme: Teaching clinical reasoning: professionalism.

Collaborations

National

Relation between biological and psychological stress and well-being, and academic performance (Karen Stegers-Jager & Andrea Woltman). This pilot study aims to investigate the relation between chronic psychological and biological stress levels and academic performance. Furthermore, both student-related factors as well as school-related factors will be studied that may influence stress levels, academic performance and students' well-being as defined by time use, including extracurricular activities, and (absence of) conflicts between life domains (study, family, work, leisure time).

Chronic psychological and biological stress levels, as measured by psychological stress questionnaires and hair cortisol concentrations respectively, and academic performance of the last medical student cohort entering before and the first cohort entering after the implementation of a strict academic dismissal policy will be compared. In this project we collaborate with the Section Endocrinology of the Department of Internal Medicine, and with the Section Pedagogical Sciences of the Faculty of Social Sciences of the EUR.

Research project on the sources of cognitive diagnostic errors and strategies to minimize them ((Henk Schmidt, Sílvia Mamede). Three studies were conducted by the iMERR research group on clinical reasoning since 2014 in collaboration with others departments in Erasmus MC:

1. the influence of difficult patients behaviors on physicians' diagnostic accuracy, two joint studies with the general practice and the internal medicine departments (article submitted for publication);

2. the effect of salient distracting clinical features reasoning on physicians' diagnostic reasoning and diagnostic performance,

3. an eye-tracking study was designed and conducted in collaboration with the neurosciences department (data is presently being analysed).

In the two last studies, direct research costs (research assistant, participants' recruitment) were covered by a grant received from the Executive Board of the Erasmus University Rotterdam.

iMERR and the general practice department have worked together on a project to improve teaching of clinical reasoning in the bachelor phase. A new format

for the course was designed by the GP department and is to be tested in April 2015. The iMERR clinical reasoning research group has provided technical support for the investigation of the effects of the new format on students' learning and satisfaction.

International

The iMERR clinical reasoning research group has collaborated with the following international partners in projects carried out or under development during 2017:

- Prof. dr. Geoff Norman and co-researchers from the McMaster University, Canada, leading to co-authored publications and a chapter in the Cambridge Handbook of Expertise, published in 2018

- Prof. Martin Fisher (Ludwig-Maximilians-University Munich), Prof. dr. Mathieu Nendaz (Geneva University), Dr. Wolf Hautz (Bern University), and Prof. dr. Charlotte Ringsted (Aarhus University Denmark) and respective co-researchers, with whom we have submitted an application to the Innovative Training Network (ITN) within the H2020 MARIE SKŁODOWSKA-CURIE Actions.

- Researchers from the Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore (Dr. Jerome Rotgans, Dr. Naomi Low-Beer), with whom an innovative research project using functional near-infrared spectroscopy (fNIRS) in research on diagnostic reasoning is ongoing. The project led to two co-authored publications in 2018.

- Researchers from the University of São Paulo and Federal University of Minas Gerais, Brazil, with whom a large study on strategies to minimize bias in diagnostic reasoning has been conducted, leading to the submission of a co-authored publication.

- Researchers from the Faculty of Medicine, Sherbrooke University, Canada (Dr. Martine Chamberland; Dr. Christina St-Onge), with whom a series of joint studies on the role of self-explanation in clinical teaching have been conducted, leading to co-authored articles submitted for publication. "

The iMERR clinical reasoning research group (Laura Zwaan) collaborates with the university of McMaster University, Canada, and the University of Washington (USA) on a project on cognitive biases in clinical reasoning. The data-gathering is currently ongoing. The project will result in a joint publication.

The iMERR clinical reasoning research group (Laura Zwaan) collaborates with Dr. Hardeep Singh (Houston Veterans Affairs Center for Innovations in Quality, Effectiveness and Safety and Baylor College of Medicine, Houston, Texas) on several papers regarding measurement of diagnostic error. This resulted in one

paper that is in press and one paper that is currently in preparation.

Research reputation

Ad hoc reviewing In 2017-2018, the iMERR researchers worked as ad hoc reviewers:

1. For the top medical education journals (Medical Education, Academic Medicine, Advances in Health Sciences Education and others) and general higher education journals (Studies in Higher Education and others) as well for manuscripts on medical education submitted to top medical journals (JAMA).
2. For international medical education conferences (Association for Medical Education in Europe- AMEE conference), including grant reviewing.

Conference Organization

Mrs. Dr. Karen Stegers-Jager is on the planning committee of the yearly conference of **the Netherlands Association for Medical Education (NVMO)**. She will host/chair the meeting in November 2019 in Rotterdam.

Mrs. Dr. Laura Zwaan is on the planning committee of the **international Diagnostic Error in Medicine conference**.

Positions in professional society

Mrs. Dr. Karen Stegers-Jager is member of the scientific committee of the NVMO.

Mrs. Dr. Laura Zwaan is the co-chair of the research committee of the Society to Improve Diagnosis in Medicine: http://www.improvediagnosis.org/?page=Committees

Editorial Board

Mrs. Dr. Laura Zwaan is on the editorial board of Diagnosis.

Prof. Dr. Walter van den Broek is on the editorial board of the Dutch Flemish Journal of Psychiatry and Current Drug Therapy.

Fellows

- Mrs. Dr. Silvia Mamede, MD, PhD, co-director of iMERR
- Mrs. Dr. Andrea Woltman, PhD, chair of the advisory board of iMERR

- Mrs. Dr. Karen Stegers-Jager, PhD, member advisory board iMERR
- Mrs. Dr. M. Dankbaar, PhD, member advisory board iMERR
- Prof Dr. Henk Schmidt, PhD, member advisory board iMERR
- Mrs. L. Zwaan, PhD, member advisory board iMERR

Associate members

- Jelmer Alsma, MD
- Prof. Dr. Patrick Bindels, MD, PhD
- Prof. Dr. Matthijs de Hoog, MD, PhD
- Mrs. Prof. Dr. Stephanie Klein Nagelvoort-Schuit, MD, PhD
- Mrs. Prof. Dr. Marise Born, PhD
- Prof. Dr. Fred Paas, PhD
- Dr Jerome Rotgans, PhD
- Mrs. Dr. Jeanine van der Rijt, PhD
- Prof. Dr. Jan van Saase, MD, PhD

Honorary members

- Prof. Dr. Geoff Norman, PhD
- Prof. Dr. Henk Schmidt, PhD
- Prof. Dr. Ir. Axel Themmen
- Prof. Dr. Els Berns

Societal impact

S Mamede: interview and chapter review for a popular science book about intelligence and decision making for Hodder and Stoughton (UK) and WW Norton (USA and Canada). The book will examine the cognitive biases that can impair the thinking of experts in many different fields - including forensic scientists, pilots, and medicine.

Interview with Laura Zwaan for RTL Nieuws (16 mei 2018)

Interview for Arts en Auto with Laura Zwaan and Charlotte van Sassen (oktober 2018)

M Van Aken, M Ten Berg, G Jager, L Zwaan Diagnosefouten verdienen meer aandacht, Medisch contact (mei 2018)

Best Oral abstract Presentation award Diagnostic Error in Medicine congress (New Orleans 2018) Laura Zwaan

Jasper Monster. De dubbele strijd voor gelijke kansen in het geneeskundeonderwijs (serie onderwijspioniers deel 6). Erasmus Magazine. September 6th 2018. Interview in the series Education pioneers at Erasmus University Rotterdam about my crusade to offer equal opportunities for all medical students in order to create a diverse doctor population.

Richard Hassink. Integriteitstest – wel of niet? Arts en Auto. March 19th 2018. Interview on the use of the integrity SJT that we developed/tested for the selection of our students.