

Australian Medical Assessment Collaboration

Assessment Framework

(Revised May 2012)



Contents

INTRODUCTION	3
THE FRAMEWORK	3
Framework objective.....	3
Framework context.....	5
Framework components	5
Process Domain.....	8
Clinical Competence.....	8
(I) <i>Cognitive: Knowing and Understanding</i>	8
(II) <i>Behavioural: Demonstrating and Implementing</i>	8
Content Domains.....	9
Medical Sciences and Practice.....	9
(I) <i>Clinical Problems and Conditions</i>	9
(II) <i>Skills and Procedures</i>	11
Professional Practice.....	14
(I) <i>Communication</i>	14
(II) <i>Clinical Management</i>	15
(III) <i>Professionalism</i>	16
Clinical Context	17
ASSESSMENT DESIGN.....	17
The pilot AMAC assessment instrument.....	18
Structure of the pilot AMAC assessment instrument.....	18
Item development	20
Reporting	20
Assessment implementation and delivery	21
Student survey	21
REFERENCES	23
ANNEX A: AMAC REFERENCE GROUP	25

Introduction

1. This project responds to the growing need for an evidence-base on which to establish graduate capability, measure success and facilitate continuous improvement in medical education in Australia. As a recent national study of medical education in Australia has affirmed, growing internationalisation of the medical profession, increasing diversification of programs and curricula, and ever-growing pressure to prove and improve academic standards heightens the need for robust and efficient assessment in medical education (DEEWR, 2008).
2. The common trend in modernising medical education is to increase the focus on graduates' competencies in clinical work, communication, collaborative skills and professionalism. There is an increasing focus on the importance of the learning outcomes of graduates in professional and academic literature (Coates et al, forthcoming; CGME, 2005; CPMEC, 2008; NFU, 2009; AMA, 2010; Van der Vleuten et al, 2010). Interest in implementing international medical assessments is also gaining pace (Archer, 2009; Gorsira, 2009; Harden, 2009; Melnick, 2009; Van der Vleuten, 2009).
3. There is considerable growing national interest in, and recognition of, the policy importance of assessing learning outcomes through objective, system wide testing. The OECD Assessment of Higher Education of Learning Outcomes (AHELO) Project (OECD, 2010), which aims to assess graduate competencies in engineering, economics, generic skills and currently has 17 participating countries, is a prime example of this.
4. The development of this collaboration is funded by a grant from the Australian Learning and Teaching Council (ALTC Project SP10-1869) and now under the direction of the Office for Learning and Teaching (OLT). The title of the ALTC/OLT project is: *Developing the foundation for a national assessment of medical student learning outcomes*. This project is being undertaken collaboratively by The University of Queensland, the Australian Council for Educational Research and Monash University.
5. In responding to concerns relating to the need to prove and improve the standards of medical education, the main aim of this project is to establish an Australian Medical Assessment Collaboration (AMAC). The aim of AMAC is to set the foundations for a national assessment to monitor the outcomes of later year medical students in Australia.
6. The project includes scoping work, sector engagement, international involvement, faculty training, development of initial criterion-referenced assessment frameworks, and the compilation and validation of sample test items. This project will provide the foundation for what will be the ongoing development and implementation of an item library that will provide a sustainable and robust means of monitoring the standards of medical education in Australia.

The Framework

Framework objective

7. This framework provides a structured conceptual understanding of the areas to be considered for assessment in the AMAC project. An assessment framework is similar to a curriculum framework, but more detailed such that it provides a robust roadmap of

areas to assess. It does not specify what is to be taught or how to teach, rather, it specifies what is to be assessed.

8. This framework articulates the learning outcomes to be attained by medical students after completing their regular medical training. It provides a structured conceptual understanding of the areas to be assessed and a reference system for assessment tasks to evaluate the coverage of assessment content. The framework provides substantive foundations for subsequent development, along with technical and practical considerations of what would be appropriate and feasible to assess.
9. In order to establish this foundation, this document provides a framework for the overall development of AMAC. The framework charts anticipated key competencies required of medical graduates, providing a basis for which items relating to assessing these competencies can be collected and utilised by universities.
10. The range of competencies expected of medical students by the time they reach graduation is substantial. These students will need to be able to demonstrate basic competencies in professional practice, professional behaviour and communication. Yet they will also need to possess an integrated body of skills and knowledge. Although beginning medical practitioners will need to be competent at handling potentially complex issues, it is expected that these graduates will still receive some level of supervision and support as they enter the professional sphere.
11. Learning outcomes are defined in the European Commission's Tuning Project report (González & Wagenaar, 2008: 16) as "statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning." Learning outcomes can be understood in terms of key competencies.
12. The OECD DeSeCo Project (2005: 4) states that: "A competency is more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context. For example, the ability to communicate effectively is a competency that may draw on an individual's knowledge of language, practical IT skills and attitudes towards those with whom he or she is communicating." Rychen & Salganik (2003: 2) argue that competence is a critical factor in the ways that individuals help to shape the world. They say that "key competencies can benefit both individuals and societies".
13. Wojtczak (2002: 6) defines competence in generic terms:

Competence: Possession of a satisfactory level of relevant knowledge and acquisition of a range of relevant skills that include interpersonal and technical components at a certain point in the educational process. Such knowledge and skills are necessary to perform the tasks that reflect the scope of professional practices. Competence may differ from 'performance', which denotes actions taken in a real life situation. Competence is therefore not the same as 'knowing', on the contrary, it may well be about recognizing one's own limits.
14. The learning outcomes in this framework, couched in terms of competencies, have been developed in general terms. They may be seen as the minimum requirements to which medical graduates should be expected to function as they enter their profession. Throughout the clinical phase of medical education, it is expected that students are exposed to authentic professional situations. It is hoped that students increasingly learn to work autonomously as medical practitioners and acquire the competencies explicated in this framework.

Framework context

15. The framework that follows is informed by many national and international assessment frameworks and curriculum documents. The most notable of these are *The 2009 Framework for Undergraduate Medical Education in The Netherlands* (NFU, 2009); *The CanMEDS 2005 Physician Competency Framework* (CanMEDS, 2005); the *Australian Curriculum Framework for Junior Doctors* (CPMEC, 2008); the *Australian Medical Council Multiple Choice Examination Specifications Booklet* (AMC, 2010); and the Australian and New Zealand Medical Deans report, *Developing a Framework of Competencies for Medical Graduate Outcomes* (MDANZ, 2011). It is informed by the processes and practices of *The Tuning Project (Medicine) – Learning Outcomes/Competences for Undergraduate Medical Education in Europe* (Cumming, A., Ross, M., 2009); the AHELO project (OECD, 2010); and the AHELO Assessment Frameworks (OECD 2011; OECD 2011a).
16. A provisional framework was drafted by ACER in April/May 2011 and presented to participants in the Engagement Forum at the end of May 2011. Participants were provided with a broad overview of the framework, and also engaged in smaller workshops to discuss this draft in more detail. Following the Forum, the draft framework was repositioned and a revised document was created. Further consultation on the framework was undertaken in September 2011 in workshops with clinicians from a range of specialisations. Revisions based on these workshops focussed on the categorisation of components in the framework. A revised version of the AMAC Assessment Framework was prepared for review by the AMAC Reference Group in March 2012. This review recommended a number of minor revisions. The result is the current document. This assessment framework is, however, a ‘living document’. It is anticipated that further revisions will be made in future phases of the AMAC project.

Framework components

17. Following are the key components of the proposed AMAC learning outcomes in terms of competencies. The assessable content has been divided into two domains: Content and Process. The two domains function together so that any given assessment task can be mapped to the content it addresses and the application of that content in either cognitive or practical contexts. A third dimension is the clinical context, which situates the expression of proficiency.
18. The lists in the content domains are largely based on the *Australian Curriculum Framework for Junior Doctors* (CPMEC, 2008), *The 2009 Framework for Undergraduate Medical Education in The Netherlands* (NFU, 2009), and *The List of Australian Recognised Medical Specialities* (AMC, 2012).
19. The first content domain is ‘Medical Sciences and Practice’, which comprises the ‘Clinical Problems and Conditions’ and ‘Skills and Procedures’ sub-domains. The second content domain is ‘Professional Practice’, which comprises the ‘Communication’, ‘Clinical Management’ and ‘Professionalism’ sub-domains. The process domain is ‘Clinical Competence’, which comprises the ‘Cognitive’ (Knowing and Understanding) and ‘Behaviourial’ (Demonstrating and Implementing) sub-domains. Content and process domains are always situated in a ‘Clinical Context’, which situates the expression of proficiency, and serves as a backdrop for any specific content or process.
20. Figure 1 illustrates how the content domains are connected with the process domain, and situated in a clinical context. The process domain is modelled on Miller’s Pyramid of clinical competence (Miller 1990; Aaron 2009). The intended implication of Figure

1 is that the practitioner's capacity broadens rather than narrows with increasing proficiency. For this reason, Miller's pyramid has essentially been inverted.

21. Figure 1 aims to illustrate that the content domains can be coupled with the process domain. The vertical bars for each content sub-domain demonstrate that each sub-domain can be assessed through a cognitive or behavioural process, and always in a clinical context. This implies that all five of the content sub-domains can be mapped to both of the process sub-domains.
22. This framework articulates the possible areas for an assessment instrument in graduate medical education according to three dimensions:
 - (i) The Content Domains:
 - Medical Sciences and Practice, which consists of two sub-domains:
 - Clinical Problems and Conditions
 - Skills and Procedures
 - Professional Practice, which consists of three sub-domains:
 - Communication
 - Clinical Management
 - Professionalism
 - (ii) The Process Domain:
 - Clinical Competence, which consists of two sub-domains:
 - Cognitive, which has two components:
 - Knowing
 - Understanding
 - Skills and Procedures, which has two components:
 - Demonstrating
 - Implementing
 - (iii) The Clinical Context.
23. The purpose of this assessment framework is twofold. Firstly, assessment items can be generated with specific reference to these three dimensions. Every assessment item should target one of the content domains, one of the process domains, and be situated in one of the clinical contexts. Secondly, assessment items from other sources can be classified according to these three dimensions. If one of the dimensions is missing, it will be clear in the process of categorisation.

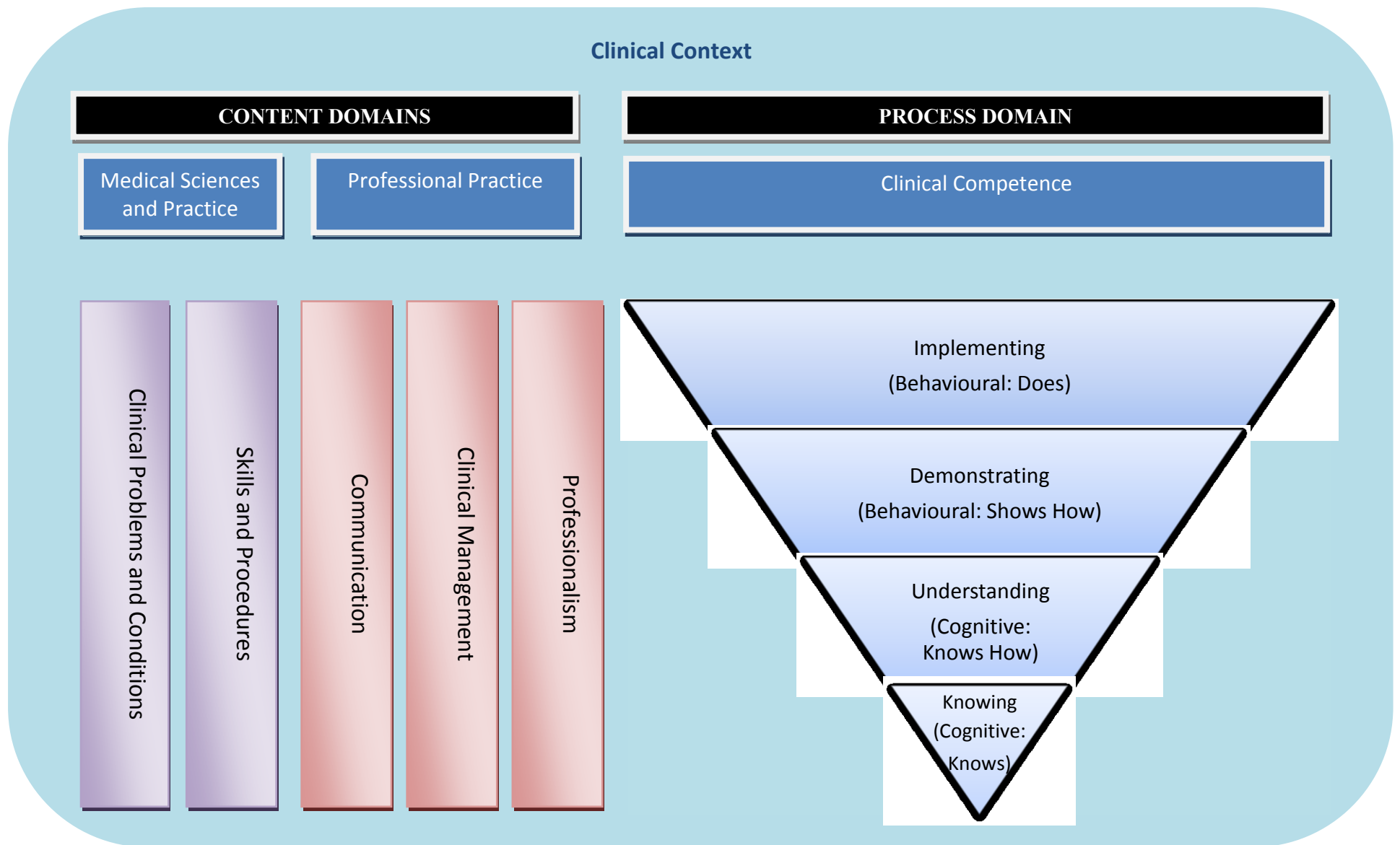


Figure 1: Framework components

Process Domain

Clinical Competence

24. The process domain, 'Clinical Competence' is derived from Miller's Pyramid (Miller 1990; Aaron 2009). There are two sub-domains, each with two components.
25. The Cognitive sub-domain comprises Knowing and Understanding. Knowing refers to processes of learning information (content and concepts) that that can be later retrieved and used. Understanding refers to the processes of using learned information to reach conclusions that are broader than the contents of any single concept.
26. The Behavioural sub-domain comprises Demonstrating and Implementing. Demonstrating refers to the expression of knowledge, skills and understanding in controlled practical contexts. Implementing refers to the demonstration of knowledge, skills and understanding in clinical workplace settings.
27. There is a natural congruence between the process domains and the types of assessment tasks they suggest. Typically, written assessments could be used to assess the cognitive domains, but any adequate assessment of the behavioural domains must include a significant proportion of practical clinical and professional activities. Thus, Multiple Choice Questions (MCQs), Extended Matching Questions (EMQs), or Constructed Response Tasks (CRTs) would naturally fit well with the cognitive domains. Yet an assessment of the process domains may need to include Mini Clinical Examinations (Mini-CEXs) or Observed Structured Clinical Examinations (OSCEs).
28. The four aspects of Miller's original pyramid relate closely to the aspects of the proposed cognitive and behavioural domains. These are now discussed in more detail.

(I) Cognitive: Knowing and Understanding

29. Knowing is the first stage in this process domain. It is a cognitive process. It is activated when student demonstrate basic knowledge of the content domains. It can be demonstrated with basic recall or recognition of definitions, descriptions or key processes.
30. Understanding is the second stage in this process domain. It is also a cognitive process. Understanding is more than simply repeating facts or basic knowledge recall. 'Knowing how' relates to how competent a student is in being able to theoretically apply what they have learnt. It demonstrates an integration of basic knowledge of the content domains and a deeper understanding of how these practices should be undertaken. In the context of AMAC, it represents higher-order clinical reasoning.

(II) Behavioural: Demonstrating and Implementing

31. Demonstrating is the first stage in this process domain. It is a behavioural process. 'Shows how' means a student can practically demonstrate their competence in the cognitive processes in controlled context-based situations.
32. Implementing is the second stage in this process domain. It is also a behavioural process. It means that students are competent in implementing their cognitive processes in authentic professional situations. This process represents the highest synthesis of the lower process sub-domains and the ability to translate these into the professional sphere.

Content Domains

33. There are two content domains. ‘Medical Sciences and Practice’ comprises Clinical Problems and Conditions which medical graduates should be familiar with, along with Skills and Procedures which medical graduates should be competent in. ‘Professional Practice’ relates to content areas of Communication, Clinical Management and Professionalism; important aspects of being a medical practitioner which fall out of the domain of Medical Sciences and Practice.

Medical Sciences and Practice

(I) Clinical Problems and Conditions

34. A competent medical graduate must possess a vast array of content knowledge of basic medical science. They should be able to identify the most likely diagnosis relating to clinical problems and conditions when presented with a scenario or vignette.
35. For this part of the assessment, the sub-domain is divided into four categories. Clinical Problems and Conditions can be categorised by the following:
- the system involved;
 - the medical speciality;
 - the medical context;
 - the demographic.
36. Assessment items can be mapped to these four categories when they are relevant, and unique assessment instruments can be built around this blueprint, emphasising certain categories when desired. The following list should not be seen exhaustive, suffice to say that any missing elements from the lists could be categorised into one of the four categories listed. It is also important to note that not every category will be mapped in any one instantiation of the assessment instrument. Decisions will need to be made as to the relative emphasis to be placed on these categories.
37. Although some duplication is inevitable (for instance, an item will undoubtedly be categorised as ‘endocrine’ system, along with the ‘endocrinology’ medical speciality), carving representations of clinical problems and conditions across these four categories should ensure that no information is lost in categorising items. The aim is to capture as many concepts as possible in classifying assessment items. This process is similar to a ‘tagging’ process utilised in many online classification systems and should be considered analogously.
38. Below is the list of systems, medical specialities, medical contexts, and demographics that items in this sub-domain of the AMAC assessment may be drawn from:

System:

- (i) Respiratory*
- (ii) Circulatory*
- (iii) Digestive*
- (iv) Nervous*
- (v) Musculoskeletal*
- (vi) Endocrine*
- (vii) Immune*
- (viii) Lymphatic*
- (ix) Reproductive*

- (x) *Urinary*
- (xi) *Integumentary*
- (xii) *Endocannabinoid*
- (xiii) *Vestibular*

Medical Speciality:

This list is based upon ‘The List of Australian Recognised Medical Specialities’ published by the Australian Medical Council (AMC, 2012).

- (i) *Anaesthesia*
- (ii) *Pain Medicine*
- (iii) *Intensive Care Medicine*
- (iv) *General Practice*
- (v) *Dermatology*
- (vi) *Emergency Medicine*
- (vii) *Sport and Exercise Medicine*
- (viii) *Oral and Maxillofacial Surgery*
- (ix) *Medical Administration*
- (x) *Physiology*
 - a. General Medicine
 - b. General Paediatrics
 - c. Cardiology
 - d. Clinical Genetics
 - e. Clinical Pharmacology
 - f. Community Child Health
 - g. Endocrinology
 - h. Gastroenterology and Hepatology
 - i. Haematology
 - j. Immunology and Allergy
 - k. Infectious Diseases
 - l. Intensive Care Medicine
 - m. Medical Oncology
 - n. Neonatal/Perinatal Medicine
 - o. Nephrology
 - p. Neurology
 - q. Nuclear Medicine
 - r. Paediatric Emergency Medicine
 - s. Palliative Medicine
 - t. Respiratory and Sleep Medicine
 - u. Rheumatology
- (xi) *Occupational and Environmental Medicine*
- (xii) *Addiction Medicine*
- (xiii) *Palliative Medicine*
- (xiv) *Public Health Medicine*
- (xv) *Rehabilitation Medicine*
- (xvi) *Sexual Health Medicine*
- (xvii) *Surgery*
 - a. Cardio-thoracic Surgery
 - b. General Surgery
 - c. Neurosurgery
 - d. Orthopaedic Surgery
 - e. Otolaryngology – Head and Neck Surgery
 - f. Paediatric Surgery
 - g. Plastic and Reconstructive Surgery

- h. Urology
- i. Vascular Surgery
- (xviii) *Obstetrics and Gynaecology*
 - a. Obstetrics and Gynaecology
 - b. Gynaecological Oncology
 - c. Maternal-Fetal Medicine
 - d. Obstetrics and Gynaecological Ultrasound
 - e. Reproductive Endocrinology and Infertility
 - f. Urogynaecology
- (xix) *Ophthalmology*
- (xx) *Pathology*
 - a. General Pathology
 - b. Anatomical Pathology (including Cytopathology)
 - c. Chemical Pathology
 - d. Forensic Pathology
 - e. Haematology
 - f. Immunology
 - g. Microbiology
- (xxi) *Psychiatry*
- (xxii) *Radiology*
 - a. Diagnostic Radiology
 - b. Diagnostic Ultrasound
 - c. Nuclear Medicine
 - d. Radiation Oncology

Medical Context:

- (i) *Primary care*
- (ii) *Emergency department*
- (iii) *Ambulatory*
- (iv) *Residential care*
- (v) *Hospital care*

Demographic:

- (i) *Adult health*
- (ii) *Women's health*
- (iii) *Men's health*
- (iv) *Paediatrics*
- (v) *Neonatal*
- (vi) *Adolescence*
- (vii) *Aged care*
- (viii) *Rural*
- (ix) *Indigenous*

(II) *Skills and Procedures*

39. A competent medical graduate must possess a vast armoury of skills and procedures. The following list helps to clarify the broad types of skills and procedures that a medical practitioner should be able to undertake. This list is based heavily on the Skills and Procedures listed in the *Australian Curriculum Framework for Junior Doctors* CPMEC, (2008). However, it is anticipated that this list will be revised in future phases of the AMAC project.

40. Assessment items can be mapped to the skills and procedures below when they are relevant, and unique assessment instruments can be built around this blueprint, emphasising certain concepts when desired. The following list should not be seen as exhaustive, suffice to say that any missing elements from the lists could be categorised into one of the categories listed. It is also important to note that not every category will be mapped in any one instantiation of the assessment instrument. Decisions will need to be made as to the relative emphasis to be placed on these categories.

41. Below is the list of skills and procedures that medical practitioners should be competent in. Items in this sub-domain of the AMAC assessment may be drawn from:

(a) *General*

Measurement

- (i) Blood pressure
- (ii) Pulse oximetry

Interpretation

- (i) Pathology
- (ii) Radiology (X-ray, CT, MRI, US, eFAST, echocardiogram, nuclear scan)
- (iii) Nuclear medicine

Diagnostic

- (i) Blood sugar testing
- (ii) Wound swap
- (iii) Blood culture

Respiratory

- (i) Oxygen therapy
- (ii) Bag and mask ventilation
- (iii) LMA and ETT placement
- (iv) Nebuliser/inhaler therapy

Therapeutic/Prophylaxis

- (i) Antibiotic
- (ii) Insulin
- (iii) Anticoagulant
- (iv) Analgesia
- (v) Steroids
- (vi) Bronchodilators

Intravenous

- (i) Intravenous infusion set-up
- (ii) Intravenous cannulation
- (iii) Intravenous drug administration
- (iv) Intravenous fluid and electrolyte therapy
- (v) Venepuncture

Injections

- (i) Intramuscular injections
- (ii) Subcutaneous injections
- (iii) Joint aspiration

(b) *Ear, Nose and Throat*

- (i) Throat swab
- (ii) Anterior rhinoscopy
- (iii) Anterior nasal pack insertion
- (iv) Auroscopy/otoscopy
- (v) External auditory canal irrigation
- (vi) External auditory canal ear wick insertion

(c) *Neurological*

- (i) Glasgow Coma Scale scoring
- (ii) Assessment of neck stiffness
- (iii) Lumbar puncture
- (iv) Papilloedema identification
- (v) Focal neurological sign identification

(d) *Surgical*

- (i) Scrub, gown and glove
- (ii) Assisting in the operating theatre
- (iii) Local anaesthesia
- (iv) Suture removal
- (v) Complex wound suturing
- (vi) Skin lesion excision
- (vii) Surgical knots and simple sound suturing

(e) *Gastrointestinal*

- (i) Rectal examination
- (ii) Anoscopy/proctoscopy
- (iii) Abdominal paracentesis
- (iv) Nasogastric tube insertion

(f) *Cardiopulmonary*

- (i) Arterial blood gas sampling and interpretation
- (ii) Peak flow measurement
- (iii) Spirometry
- (iv) 12 lead electrocardiogram recording and interpretation
- (v) Pleural effusion/pneumothorax aspiration
- (vi) Central venous line insertion

(g) *Ophthalmic*

- (i) Eye drop administration
- (ii) Eye bandage application
- (iii) Eye irrigation
- (iv) Eyelid eversion
- (v) Visual field assessment
- (vi) Visual acuity assessment
- (vii) Direct ophthalmoscopy
- (viii) Corneal foreign body removal
- (ix) Intraocular pressure estimation
- (x) Slit lamp examination

(h) *Urogenital*

- (i) Bladder catheterisation
- (ii) Urine dipstick interpretation
- (iii) Bladder scan
- (v) Urethral swab

(i) *Mental health*

- (i) Suicide risk assessment
- (ii) Application of Mental Health Schedule
- (iii) Alcohol withdrawal scale use
- (iv) Mini-mental state examination
- (vi) Psychiatric Mental State examination

- (j) *Women's health*
 - (i) Foetal heart sound detection
 - (ii) Palpitation of the pregnant abdomen
 - (iii) Urine pregnancy testing
 - (iv) Speculum examination
 - (v) Diagnosis of pregnancy
 - (vi) Endocervical swap / PAP smear
 - (vii) Gynaecological pelvic examination
- (k) *Child health*
 - (i) Newborn examination
 - (ii) Apgar score examination
 - (iii) Neonatal and Paediatric Resuscitation
 - (iv) Infant/child dehydration assessment
 - (v) Infant respiratory distress assessment
- (l) *Trauma*
 - (i) Pressure haemostasis
 - (ii) Volume haemostasis
 - (iii) Peripheral neurovascular assessment
 - (iv) Plaster cast/splint limb immobilisation
 - (v) Joint relocation
 - (vi) Immobilisation of cervical spine
 - (vii) Cervical collar application
 - (viii) Peripheral neurovascular assessment
 - (ix) Intercostal catheter insertion

Professional Practice

- 42. A competent medical graduate must possess several essential attributes in order for them to be effective medical practitioners. These attributes belong to a separate domain from Medical Sciences and Practice as they do not all relate directly to medicine. However, they are important attributes of a competent medical practitioner.
- 43. Assessment items can be mapped to the following Professional Practice sub-domains below when they are relevant, and unique assessment instruments can be built around this blueprint, emphasising certain concepts when desired. The following list should be not be seen exhaustive, suffice to say that any missing elements from the lists could be categorised into one of the categories listed. It is also important to note that not every category will be mapped in any one instantiation of the assessment instrument. Decisions will need to be made as to the relative emphasis to be placed on these categories.

(I) Communication

- 44. The ability to be an effective communicator as a medical practitioner is identified in the Professional Practice sub-domain. Items in this sub-domain of the AMAC assessment may be drawn from the following categories:
 - (a) *Patient interaction*
 - (i) Ensuring an appropriate environment for patient interaction is arranged;
 - (ii) Treating patients with respect in a courteous manner, and being sensitive of cultural and/or religious backgrounds;

- (iii) Providing information with the principles of good communication, and implementing the principles of open disclosure;
- (iv) Showing empathy and compassion when interacting with patients;
- (v) Communicating with families or carers and respecting their role in patient health care.
- (vi) Employing effective listening skills.

(b) Managing information

- (i) Keeping up-to-date records of patient data;
- (ii) Undertaking appropriate written communication, such as referrals and GP letters;
- (iii) Accurately documenting drug prescription;
- (iv) Adequately handing-over a patient to other medical practitioners with a dedication to continuity of care.

(c) Collaboration

- (i) Working effectively with other healthcare professionals;
- (ii) Understanding the structures and dynamics of interdisciplinary teamwork;
- (iii) Demonstrating respect for colleagues
- (iv) Presenting cases to other health professionals.

(II) Clinical Management

45. The ability to engage in effective clinical management is identified in the Professional Practice sub-domain. Items in this sub-domain of the AMAC assessment may be drawn from the following categories:

(a) Patient assessment

- (i) Taking a medical history;
- (ii) Examining and assessing a patient;
- (iii) Synthesising clinical information and formulating a provisional diagnosis;
- (iv) Demarcating between possible diagnoses relevant to a patient's condition;
- (v) Carrying out investigations into a patient's health issues;
- (vi) Following-up and interpreting investigation results;
- (vii) Providing relevant referrals, collaborate with other health professionals, and arranges for future consultation relating to a particular condition.

(b) Patient management

- (i) Identifying and justifying possible patient management options and discussing these with other practitioners;
- (ii) Providing solutions for acute clinical problems including pain management;
- (iii) Generating plans for management of chronic conditions;
- (iv) Prescribing while taking into account indications, monitoring requirements, and potential adverse affects of medications;
- (v) Identifying the need for community care;
- (vi) Planning for discharge of patients;
- (vii) Appropriately arranging support for dying patients.

(c) Emergency management

- (i) Prioritising patients and assessing when emergency management should be implemented;
- (ii) Implementing basic life support, such as basic airway management, ventilator and circulatory support;
- (iii) Participating in decision making and identifying when advance life support is necessary;
- (iv) Identifying important factors in, and the management of, acute patient transfer.

(d) *Safety*

- (i) Following procedures and systems in order to minimise errors and managing the complex interactions between patient, medical practitioner, and the healthcare environment;
- (ii) Minimising risk in the workplace;
- (iii) Implementing aspects of medical safety, such as radiation safety, the management of infectious diseases, and medication safety.

(III) *Professionalism*

46. The ability to demonstrate professionalism as a medical practitioner is identified in the Professional Practice sub-domain. Items in this sub-domain of the AMAC assessment may be drawn from the following categories:

(a) *Professional behaviour*

- (i) Behaving in a professional manner which upholds the responsibilities of being a medical practitioner, including an understanding of standards and regulations;
- (ii) Demonstrating respect for colleagues;
- (iii) Demonstrating effective time management;
- (iv) Acknowledging the complex ethical nature of healthcare, following professional and ethical codes of conduct, and accepting responsibility for ethical decisions.

(b) *Health and Society*

- (i) Promoting health and wellness and being an advocate for health promotion;
- (ii) Educating others on aspects of health and illness prevention.

(c) *Scholarship*

- (i) Engaging in self-directed learning;
- (ii) Undertaking continuing professional development, maintenance and extension of skill set;
- (iii) Contributing to and initiating research;
- (iv) Reflecting on and learning from clinical practice.

Clinical Context

47. A third dimension in the assessment framework is the Clinical Context. The Clinical Context situates the expression of proficiency in assessment items. Instead of being an element of proficiency itself, the Clinical Context contextualises both the content of an assessment item and the process involved in the assessment item.
48. Assessment items can be mapped to the Clinical Contexts below when they are relevant, and unique assessment instruments can be built around this blueprint, emphasising certain concepts when desired. The following list should not be seen exhaustive, suffice to say that any missing elements from the lists could be categorised into one of the categories listed. It is also important to note that not every category will be mapped in any one instantiation of the assessment instrument. Decisions will need to be made as to the relative emphasis to be placed on these categories.
49. Below is the list of Clinical Contexts that that items in the AMAC assessment may be drawn from:
 - (i) *Making a diagnosis*
 - (ii) *Decision making*
 - (iii) *Interpreting data*
 - (iv) *Medical testing*
 - (v) *Medical knowledge recall*
 - (vi) *Prescriptions*
 - (vii) *Gathering information*
 - (viii) *Patient assessment*

Assessment design

50. The framework components identify what it is possible to assess, but it makes no judgment as to what will be assessed in any assessment instrument, or where emphasis will be placed within different content or process domains. In designing assessment instrument, the blueprint articulated in this framework can be used to guide instrument development.
51. The lists in the sub-domains of the framework are purposely detailed. The reason is that with a high level of granularity, there is greater flexibility in how assessments are designed. Once a decision is made regarding what is to be assessed, the concepts and categories in the sub-domains may be aggregated or collapsed for a purpose, but they do not have to be.
52. As mentioned earlier, there is a natural congruence between the process domains and the types of assessment tasks they suggest. Once a decision is made regarding the types of assessment which will be undertaken, the assessment instruments can be built according to this assessment framework.

The pilot AMAC assessment instrument

53. The pilot AMAC instrument will only assess the Clinical Problems and Conditions sub-domain of the Medical Sciences and Practice content domain, and the Cognitive process sub-domain. The Skills and Procedures sub-domain, the Professional Practice content domain and the Behavioural process sub-domain will not be assessed. Hence, **the instrument will assess students' knowledge and understanding of the Clinical Problems and Conditions sub-domain in a clinical context.**
54. The reasons for this are two-fold: firstly, due to funding and time constraints, it is more efficient to develop a test comprising of MCQs; secondly, in the spirit of feasibility and continuous improvement, the AMAC project team believes that the AMAC assessment instrument will be able to expand once it is instantiated.
55. It is envisaged that both the Medical Sciences and Practice and Professional Practice content domains, and the Cognitive and Behavioural process domains will be assessed in future incarnations of the AMAC instrument. However, this assessment design may need to incorporate forms of assessment, such as Mini-CEXs or OSCEs. Fortunately, it may be possible to simulate these types of assessment through interactive assessment items in a constructed response format. These items can be pitched 'above content' and will have natural congruence with the Process Domains and the Professional Practice Content Domain.

Structure of the pilot AMAC assessment instrument

56. The duration of the pilot AMAC assessment instrument is 120 minutes. The pilot AMAC instrument assesses students' knowledge and understanding of the Clinical Problems and Conditions sub-domain only. The assessment includes a broad sample of items covering a range of difficulty that will enable the strengths and weaknesses of populations and key subgroups to be determined with respect to the components of the framework.
57. Students will respond to 100 MCQs, each with 1 single correct answer and 4 distractors. MCQs provide a fast and efficient way to collect data on students' medical knowledge and understanding. In total, 120 MCQs will be developed, grouped into 6 sets of 20 items. There are a number of possible rotations for the assessment instrument, as indicated in Table 1. Data can be obtained from students' responses to all items, however, at the institutional level.

Table 1: AMAC assessment instrument rotations

Rotation	Multiple Choice Set				
1	MCQSET1	MCQSET2	MCQSET3	MCQSET4	MCQSET5
2	MCQSET2	MCQSET3	MCQSET4	MCQSET5	MCQSET6
3	MCQSET3	MCQSET4	MCQSET5	MCQSET6	MCQSET1
4	MCQSET4	MCQSET5	MCQSET6	MCQSET1	MCQSET2
5	MCQSET5	MCQSET6	MCQSET1	MCQSET2	MCQSET3
6	MCQSET6	MCQSET1	MCQSET2	MCQSET3	MCQSET4

58. Future incarnations of the AMAC assessment instrument may include other types of assessments. Mini-CEXs or OSCEs may be simulated in CRTs, where students respond to interactive stimuli pitched in an 'above content' manner.

59. Tables 2, 3 and 4 show possible emphasis for process and content domains and clinical contexts for the pilot AMAC instrument.

Table 2: Possible Process Domain emphasis AMAC assessment instrument

Process Sub-Domain	Component	Percentage
<i>Cognitive</i>	Knowledge	25%
<i>Cognitive</i>	Understanding	75%
		<i>Total = 100%</i>

Table 3: Possible Content Domain emphasis AMAC assessment instrument

Content Sub-Domain	Component	Percentage
<i>Clinical Problems and Conditions</i>		
<i>System</i>	<i>Respiratory</i>	15%
<i>System</i>	<i>Circulatory</i>	15%
<i>System</i>	<i>Digestive</i>	10%
<i>System</i>	<i>Nervous</i>	10%
<i>System</i>	<i>Musculoskeletal</i>	8%
<i>System</i>	<i>Endocrine</i>	8%
<i>System</i>	<i>Immune</i>	8%
<i>System</i>	<i>Lymphatic</i>	8%
<i>System</i>	<i>Reproductive</i>	8%
<i>System</i>	<i>Urinary</i>	8%
<i>System</i>	<i>Others</i>	10%
		<i>Total = 100%</i>
<i>Medical Speciality</i>	<i>Cardiology</i>	15%
<i>Medical Speciality</i>	<i>Gastroenterology and Hepatology</i>	15%
<i>Medical Speciality</i>	<i>Endocrinology</i>	10%
<i>Medical Speciality</i>	<i>Haematology</i>	10%
<i>Medical Speciality</i>	<i>Oncology</i>	8%
<i>Medical Speciality</i>	<i>Infectious diseases</i>	8%
<i>Medical Speciality</i>	<i>Neurology</i>	8%
<i>Medical Speciality</i>	<i>Urology</i>	8%
<i>Medical Speciality</i>	<i>Immunology</i>	8%
<i>Medical Speciality</i>	<i>Clinical Pharmacology</i>	8%
<i>Medical Speciality</i>	<i>Others</i>	10%
		<i>Total = 100%</i>
<i>Medical Context</i>	<i>Primary care</i>	45%
<i>Medical Context</i>	<i>Emergency department</i>	45%
<i>Medical Context</i>	<i>Others</i>	10%
		<i>Total = 100%</i>
<i>Demographic</i>	<i>Adult health</i>	50%
<i>Demographic</i>	<i>Women's health</i>	15%
<i>Demographic</i>	<i>Men's health</i>	15%
<i>Demographic</i>	<i>Paediatrics</i>	15%
<i>Demographic</i>	<i>Others</i>	5%
		<i>Total = 100%</i>

Table 4: Clinical Context emphasis AMAC assessment instrument

Clinical Context	Percentage
<i>Making a diagnosis</i>	50%
<i>Decision making</i>	15%
<i>Medical testing</i>	15%
<i>Medical knowledge recall</i>	10%
<i>Others</i>	10%
	<i>Total = 100%</i>

Item development

60. Item collection and test construction will be based on this framework document. This document will be referred to by the medical experts in the team and clinicians involved in consultation workshops in order to determine the appropriate mix of items for test forms. This will ensure both credibility of the instrument as a whole and coverage of key content areas.
61. It is anticipated that items will be submitted by participating medical schools. A ratio of at least 3:1 is recommended. That is, as the assessment is to consist of 120 items, at least 360 items should be submitted. This allows for a high attrition rate if necessary and ensures that every selected item is ratified by all interested parties.
62. Items will reviewed and revised to map to the framework and to ensure consistency and continuity, before being subject to a rigorous quality assurance process. Items will be validated by medical education experts and clinicians before being trialled in test forms for psychometric analysis and calibration.
63. The AMAC assessment instrument is thus designed to achieve consistency, fairness and standardisation in assessment through the development of high quality assessment items, validated by qualified and experienced medical education experts and clinicians.
64. One possible outcome of AMAC is housing the items in an ‘item-bank’ library, where items are categorised according to their mapping to the assessment framework. Items can then be made available for future incarnations of the AMAC assessment instrument.

Reporting

65. For the current ALTC/OLT project, the aim is to build a broad exam that covers a range of content areas from the Clinical Problems and Conditions sub-domain. The items will contribute to one overall ‘capability’ score, which can be compared with a ‘benchmark’ score of the overall cohort. Outcomes to the test will also be reported to students disaggregated to a number of categories from the Clinical Problems and Conditions sub-domain.
66. Future iterations of the AMAC instrument may work towards creating subscales for particular content areas, but this is not feasible in this development project. Similar to the PISA reporting practice (OECD, 2009b) and AHELO reporting model (OECD, 2011; OECD, 2011a) results can be reported on a scale constructed using a generalised form of the Rasch model. Underlying the construction of a scale are several assumptions: that there is a latent trait (as specified in the assessment framework) that can be represented by a continuous variable and is possessed by test-takers; that test items can be constructed that

require the test-taker to use this trait in responding to items; and that the amount of the trait possessed by test-takers is a function of the score they receive on the test. The form of the Rasch model that is used employs the scores obtained by students to produce estimates for both the difficulty of items and the ability of students on a single real-valued scale. The scale is constructed so as to have a mean score of 500 and standard deviation of 100. Accordingly, about two-thirds of the test-takers would score between 400 and 600 points.

Assessment implementation and delivery

67. The assessment will be administered via computer through an online testing platform. Doing so has several benefits, as outlined in the next few paragraphs.
68. One benefit is the opportunity to capture and measure data that relate to processes and strategies. It is possible to record data such as the type, frequency, length and sequence of actions performed by students. Another benefit is that the time students spend on any particular item can be restricted, where it is considered appropriate. This is particularly useful in contexts where students are exploring stimulus material interactively.
69. While not possible in the pilot study, a broader benefit of measuring delivering the AMAC assessment by computer is that dynamic stimulus material can be produced, including: visuals such as video clips and animations; environments where students interact with features to investigate a medical scenario; and simulations where students can interact with patients and medical contexts.
70. It is also possible to deliver items in a fixed order, or 'lockstep' fashion if desired. The lockstep procedure means that students are not able to return to an item or unit once they have moved to the next one. Each time students click the 'Next' button a dialog box displays a warning that they are about to move on to the next item and that it is not possible to return to the previous item. At this point, students can either confirm they want to move on or cancel the action and return to the current item. An advantage of this approach is that it maximises the independence of items within and across units, since students cannot find clues in later tasks that might help them to answer earlier ones. Put more positively, later items can reveal the answers to earlier items without enabling previous answers to be changed.
71. With a computer-based assessment, MCQs are coded automatically (by computer). In some instances it may also be possible to automatically code short answer responses. This minimises the possibility of human error. Any responses that cannot be coded automatically are collected by the computer-delivery system and saved in an appropriate format. An online coding system facilitates coding (by experts) of these saved files. This eliminates the need for separate data entry, minimises the need for data cleaning, and allows coding to take place 'off site' if desired.

Student survey

72. At the completion of the assessment instrument, students will be asked to complete a small number of survey questions using the same online testing platform. These questions are necessarily brief, but in the context of building a useful assessment tool, will help to gather some specific student feedback in relation to the instrument overall. Survey items in this regard relate to the extent to which students made an effort in completing the test, their perceptions of the instrument in terms of relevance to the knowledge gained through their

degree and the extent to which the assessment addresses knowledge that they perceive to be relevant to future professional practice.

73. The survey also collects additional information about a range of demographic characteristics of the student which can potentially be used for more detailed analyses overall and at the item level.

References

- Aaron, S., (2009), Moving Up the Pyramid: Assessing Performance in the Clinic, *The Journal of Rheumatology*, 36(6): 1101-1103.
- ACGME, (2005), *The ACGME Outcome Project*, Chicago: Accreditation Council for Graduate Medical Education.
- AMA, (2010), *Position Statement: Competency-based training in medical education*. Australian Medical Association. Accessed 9 May 2011 from: <http://ama.com.au/node/5977>
- AMC, (2010), *AMC Accreditation Report*, University of Queensland, School of Medicine.
- AMC, (2011), *Multiple Choice Examination Specifications Booklet*, Accessed 3 May 2012 from: http://www.amc.org.au/images/publications/amc_exam_spec.pdf
- AMC (2012), *The List of Australian Recognised Medical Specialities*, Accessed 3 May 2012 from: <http://www.amc.org.au/images/Recognition/AMC-list-of-specialties.pdf>
- Archer, J., (2009), European licensing examinations – the only way forward, *Medical Teacher*, 31:215-216.
- CanMEDS, (2005), *The CanMEDS 2005 Physician Competency Framework*, Ottawa: The Royal College of Physicians and Surgeons of Canada. Accessed 12 May from: http://rcpsc.medical.org/canmeds/bestpractices/framework_e.pdf
- Carreras, J. (2008), *Assessment of Undergraduate Medical Education Competencies*, AMSE Annual Conference Barcelona 2008. Accessed 9 May 2011 from: <http://www.amse-med.eu/documents/Carreras.doc>
- Coates, H., Wilkinson, D., Glasgow, N., Richardson, S., (2011), Generalisable assessment of learning outcomes in Australian medical education: options for consideration. National Assessment Forum, The University of Queensland, Brisbane.
- CPMEC, (2008), *Australian Curriculum Framework for Junior Doctors*, Accessed 4 May 2011 from: <http://www.cpmec.org.au/ACF-2010/index.cfm>
- Cumming, A., Ross, M., (2009), *The Tuning Project (Medicine) — Learning Outcomes/Competences for Undergraduate Medical Education in Europe*. Edinburgh: University of Edinburgh. Available online: <http://www.tuning-medicine.com/pdf/booklet.pdf>
- DEEWR, (2008), *What makes for success in Medical Education: Australian Medical Education Study*, Canberra: Department of Education, Employment and Workplace Relations.
- González J. and R. Wagenaar (eds.) (2008). *Tuning Educational Structures in Europe. Universities' contribution to the Bologna Process. An Introduction*. 2nd. Ed, Bilbao-Groningen.
- Gorsira, M., (2009), The utility of (European) licensing examinations, *Medical Teacher*, 31:221-222.

- Harden, R., (2009), Five myths and the case against a European or national licensing examination, *Medical Teacher*, 31:217-220.
- Laan, R., Leunissen, R., van Herwaarden, C., (2010), The 2009 Framework for Undergraduate Medical Education in The Netherlands. *Undergraduate Medical Education*, 29: 10-15.
- Melnick, D., (2009), Licensing examinations in North America: is external audit valuable? *Medical Teacher*, 31:212-214.
- Miller, G., (1990), The Assessment of Clinical Skills/Competence/Performance, *Academic Medicine*, 65, S63-7.
- MDANZ (2011), *Developing a Framework of Competencies for Medical Graduate Outcomes*, Accessed 3 May 2012 from: <http://www.medicaldeans.org.au/wp-content/uploads/Competencies-Project-Final-Report1.pdf>
- NFU (2009), *The 2009 Framework for Undergraduate Medical Education in The Netherlands*, Utrecht: Nederlandse Federatie Van Universitair Medische Centra. Available online: http://www.nfu.nl/fileadmin/documents/Raamplan2009engelstalige_versie.pdf
- OECD, (2005), *DeSeCo Project: - The Definition and Selection of Key Competencies: Executive Summary*, Paris: Organisation for Economic Cooperation and Development. Available online: <http://www.oecd.org/dataoecd/47/61/35070367.pdf>
- OECD (2009). *PISA 2009 Assessment Framework*. Paris: Organisation for Economic Cooperation and Development.
- OECD, (2010), *Assessment of Higher Education Learning Outcomes: Feasibility Study*, Paris: Organisation for Economic Cooperation and Development.
- OECD, (2011), *Module B Assessment Framework (Economics)*, Paris: Organisation for Economic Cooperation and Development.
- OECD, (2011a), *Module C Assessment Framework (Engineering)*, Paris: Organisation for Economic Cooperation and Development.
- Rychen D. S. and Salganik, L. H. (Eds.). (2003). *Key Competencies for a Successful Life and a Well-Functioning Society*. Göttingen, Germany: Hogrefe and Huber.
- Van der Vleuten, C. (2009) National, European licensing examinations or none at all? *Medical Teacher*, 31:189-191.
- Van der Vleuten, C., Schuwirth, L., Scheele, F., Driessen, E., Hodges, B., (2010), The assessment of professional competence: building blocks for theory development, *Best Practice and Research Clinical Obstetrics and Gynaecology*, 24:703-719.
- Wojtczak, A. (2002), Glossary of Medical Education Terms: Part 1, *Medical Teacher*, 24(2). 216-219. Available online: http://esmeprogramme.org/amee2006/pdf/Occasional_03.pdf

Annex A: AMAC Reference Group

- Professor Richard Hays – representative of Medical Deans of Australia and New Zealand (MDANZ).
- Ms Siobhan Lenihan – representative of the Office of Learning and Teaching (OLT).
- Mr James Churchill – President of the Australian Medical Students’ Association (AMSA).
- Associate Professor Terry Brown – representative of the Confederation of Postgraduate Medical Education Councils (CPMEC).