TRAINING MODULE
DEVELOPER HANDBOOK

A guide for developing
procedural skills training modules.

Last updated: Jun 30, 2024

self
surgical education
learners forum

What is this handbook?

This handbook is designed to help people develop procedural skill training modules for surgical practitioners in resource-constrained environments. We'll assume that's you! 👋

Module developers can use this handbook to plan and build comprehensive training modules. It includes contextual information, resources, and step-by-step instructions for building a training module.

This handbook includes:

- ➔ An overview of the Surgical Education Learners Forum (SELF), Community of Practice, the Global Surgical Training Challenge, and the SELF Symposium.
- ➔ The vision and general expectations of SELF.
- ➔ A description of the types of training modules supported by SELF.
- ➔ The financial and non-financial resources available to support training module development — including details about the Clinical Skill Training Grant, which provides up to US$75,000 for developing training modules.
- ➔ Resources, such as checklists, used in the development of a SELF training module.

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How to Build a SELF Training Module

Step 1: Introducing the SELF Training Module Framework

At the core of a SELF training module is the idea that a surgical practitioner can learn a specific skill by themselves and in their preferred location. To do this, a surgical practitioner must be able to learn independently and practise a specific skill.

In traditional medical training, a learner receives guidance and feedback from an instructor. SELF training modules work differently by providing learners with guidance and feedback *from the training module itself.*

Developing a training module that enables independent learning is challenging. It requires consideration, creativity, and experimentation.

Fortunately, members of the SELF community have already developed several training modules and practical frameworks that are designed to help developers build effective training modules.

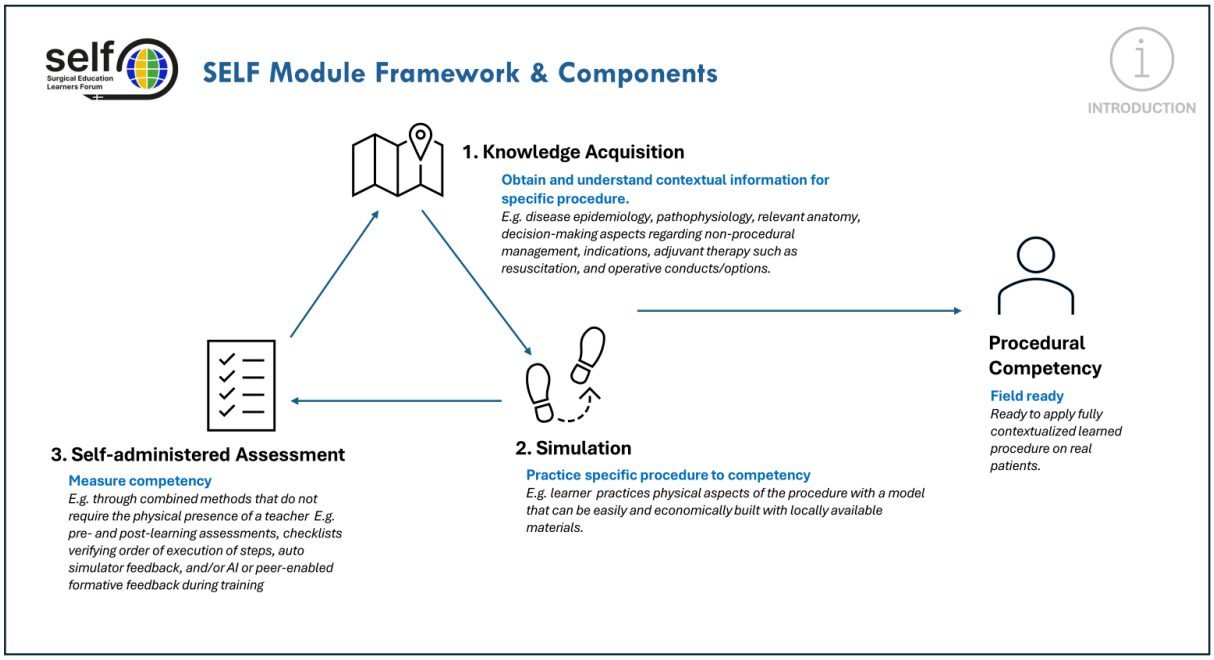
The following SELF training module framework outlines the key components that enable independent skills training:

1. **Knowledge acquisition** → Learners must acquire the knowledge needed to appropriately apply a specific skill in the right context. Each training module provides the learner with information on the related disease, including its epidemiology, pathophysiology, and relevant anatomy. The training module also covers the decision-making aspects of non-operative or non-procedural management, surgical indications, adjuvant medical therapy, and operative conducts or options.
2. **Simulation training** → Learners must apply their knowledge by practising the psychomotor aspects of a skill using a physical simulator. SELF training modules include clear instructions for building a simulator using cost-effective, locally-available materials. These materials must achieve appropriate fidelity to ensure the learner can safely translate their skill into clinical practice.
3. **Self-administered skills assessment (SASA)** → Learners must receive feedback to confidently, competently, and safely apply their new skills into clinical practice. SELF training modules use a self-administered

skills assessment framework to provide targeted, formative feedback on the learner's execution of the skill. Self-administered skills assessment can include the following:

a. pre- and post-learning assessments;
b. checklists to verify understanding and appropriate order of execution of steps;
c. feedback from the simulator itself on the execution of the physical skill; and/or
d. formative feedback during simulation training via artificial intelligence and/or peers.

Each self-administered skills assessment technique must be designed to function without the direct involvement of an instructor.



Step 2: Define the Target Learner & Learning Objective

Identify and describe the target learner who is expected to engage with the training module. Consider the target learner's educational and professional training, learning and working environment, health profession, speciality, career goals, learning styles, and preferences.

It is important to understand the starting and end point for the learner when designing a SELF module in order to create a clear and effective scope and sequence. To establish the starting or end point for the learner, consider the following questions, among others:

- ➔ What is the minimum level of training and skill required to engage with the training module?
- ➔ What prerequisite skills does the learner need to have to engage with the training module?
- ➔ What should a learner expect to be able to demonstrate after completing the training module to a specific level of competency?

By better understanding the target learner, developers can create training modules that are engaging, effective, and responsive to the specific needs of the learner.

In addition to describing the start and end points of the training module, you may also want to consider the target learner's broader context, which will inform the development of the training module, including the following:

- ➔ Background Knowledge and Experience: Describe the learner's existing knowledge base and prior experience relevant to the subject matter of the training module.
- ➔ Learning Objectives: Describe what the learner aims to achieve by completing the training module, including specific learning objectives.
- ➔ Motivation: Describe the learner's level of motivation and reasons for undertaking the training, which can influence engagement and commitment.
- ➔ Language Proficiency: Consider the learner's proficiency in the language(s) used for instruction and communication, ensuring that language barriers do not hinder comprehension or engagement.

- ➔ **Cognitive Abilities**: Consider the learner's cognitive abilities, such as critical thinking skills, problem-solving abilities, and capacity for abstract reasoning.
- ➔ **Personal Characteristics**: Consider factors like personality traits, attitudes towards learning, and cultural background that may affect their engagement and interaction with the training content.
- ➔ **Learning Environment**: Consider factors such as availability of electricity, level of connectivity to digital resources, and access to necessary materials to optimise the learning experience.
- ➔ **Technology Literacy**: Describe the learner's level of familiarity or comfort with technology and digital tools, since this informs decisions on the development of any multimedia and interactive elements in the module.
- ➔ **Time and Availability**: Consider constraints affecting the learner's time, such as their ability to commit to completing the module within a given timeframe.
- ➔ **Feedback Preferences**: Consider how the learner prefers to receive feedback on their progress and performance throughout the training.
- ➔ **Accessibility Needs**: Identify any accessibility requirements or accommodations necessary to ensure the learner can fully participate in and benefit from the training.
- ➔ **Career Stage and Aspirations**: Consider where the learner stands in their career journey and how the training module aligns with their professional development aspirations.

Step 3: Define the Target Skill

Identify and describe the specific psychomotor skill that the training module will teach. Psychomotor skills involve the coordination of both physical movements and cognitive decision-making.

Remember that the learner must be able to train at their local site of practice, on their own time, and without the need for a physically-present instructor.

Step 4: Deconstruct the Task

Keeping the target learner, learning objectives, and psychomotor skills in mind, break the surgical task down into its component parts or steps. This is called **task deconstruction**, and it provides clarity into what to prioritise in the design and development of a training module.

In task deconstruction, a "task" refers to any specific action or duty that needs to be carried out as part of a surgical procedure. Tasks can vary in complexity and may include preparatory steps, intraoperative actions, or postoperative care responsibilities.

Complete the task deconstruction using the following process:

1. Outline the surgical task into both physical and decision-making steps.
2. For each step, identify the type of tissues engaged.
3. Evaluate the uniqueness of each step on a three point scale. These scores help to identify which task(s) could be the focus of the training module – and which task(s) are common enough that other existing training modules already effectively train on the skill.
4. Identify the steps that received the most unique scores on the scale. Starting with the most unique step, list the interactions with the simulated tissues that are essential for translation to clinical applications. Account for elements such as colour, anatomical shape/relationships, variability in those anatomical relationships, response to blunt or sharp dissection, "drillability", elasticity, rigidity, tactility, auditory, olfactory, or consistency of texture.
5. Identify the tissue fidelity types that are essential to performing the task.
    - Recognise that visual and tactile fidelity requirements are not universal – they are dependent upon the target learner's experience, the procedure type, and the likelihood of incorrect technique causing complications.
    - For example, a more experienced learner may be able to suspend disbelief when a tissue has low tactile fidelity and learn an essential element of a surgical step from visual fidelity alone. Alternatively,

when the performance of the step is dependent on the characteristics of the material — such as sewing bowel to pancreas — anything but identical physical characteristics is likely to have the clinician practising inappropriate techniques with potentially deadly consequences.

- Simplification after completing the task deconstruction serves to maximise cost-effectiveness and fidelity with minimal complexity while addressing the learning objective.

6. Using the simulator materials database, choose the appropriate materials for simulated tissues for all essential interaction steps. The materials database is accessible on Appropedia and on SURGhub.

Surgical Step	Tissue	Manipulation type	Uniqueness	Desired type of feedback to the learner	Fidelity Type
Step 1					
Step 2					
Step 3 ...					

Step 5: Choose a Self-administered Skill Assessment Method

Learners must receive feedback to confidently, competently, and safely apply their new skills into clinical practice. SELF training modules use a self-administered skills assessment framework to provide targeted, formative feedback on the learner's execution of the skill. Self-administered skills assessment can include the following:

- ➔ pre- and post-learning assessments;
- ➔ checklists to verify understanding and appropriate order of execution of steps;
- ➔ feedback from the simulator itself on the execution of the physical skill; and/or
- ➔ formative feedback during simulation training via artificial intelligence and/or peers.

Use the self-administered skills assessment checklist to create a comprehensive method for the target learner to self-assess their skill acquisition. The checklist include the following key steps:

1. Create a rubric that defines learning objectives, connects those objectives with the deconstructed tasks, and creates an objective scale to grade skill performance.
2. Consider the principles for effective skill assessment listed in the checklist.
3. Review other assessment methods used in other SELF modules for inspiration or adaptation.
4. Select and develop a self-administered skills assessment method that uses either:
    a. Performance measures, such as peer-to-peer or AI-powered video-based assessments, to compare learner performance with others in an objective manner.
    b. Product measures that evaluate the endpoint of a simulator after skill practice.

Step 6: Develop Knowledge Acquisition Material

Learners must acquire the knowledge needed to appropriately apply a specific skill in the right context. Each training module provides the learner with information on the related disease, including its epidemiology, pathophysiology, and relevant anatomy. The training module also covers the decision-making aspects of non-operative or non-procedural management, surgical indications, adjuvant medical therapy, and operative conducts or options.

Develop the educational content required to effectively contextualise the specific skill the training module aims to teach.

Consider the way you intend to deliver your knowledge acquisition material. The SELF Community of Practice has outlined a developer platforms checklist to help you select an appropriate digital platform for delivering the training module.

Step 7: Develop or Adapt the Physical Simulator

SELF training modules must include clear instructions for building a simulator using cost-effective, locally-available materials. These materials must achieve appropriate fidelity to ensure the learner can safely translate their skill into clinical practice.

There are many approaches to developing a simulator. Developers can access the resources and advice from the SELF Community of Practice, as described later in this handbook.

Step 8: Submit Simulator Instructions for Buildability Review

Developers can submit their simulator build instructions for independent review by members of the SELF Community of Practice. Members provide practical feedback on the usefulness of the simulator build instructions and offer ideas for improvement.

Developers use this feedback to improve the clarity of instructions and buildability of their simulator. This review process can occur multiple times.

Step 9: Conduct Self-administered Skills Assessment Testing

Developers conduct tests on the effectiveness of their self-administered skills assessment. Evidence should be collected to compare the self-administered skills assessment with more traditional instructional methods. Testing ensures that the chosen self-administered assessment method effectively measures skill acquisition with high accuracy and reliability.

Developers use the developer evidence generation checklist throughout the testing steps.

Step 10: Conduct Contextual Knowledge Testing

Developers conduct tests to verify that learners completing the knowledge acquisition components of the training module can accurately identify when the procedure should and should not be done in clinical contexts. Developers continue to use the developer evidence generation checklist throughout the testing steps.

Step 11: Iterate, Test, & Improve

Developers should continue making improvements to their entire training module in a continuous cycle. The goal of iteration is to incorporate learner feedback and testing data to make small and substantial improvements to their knowledge acquisition materials, simulator design and buildability, and self-administered skills assessment method.

Build Evaluation Package

Researchers are among the members of the SELF Community of Practice. These researchers are dedicated to testing the effectiveness of SELF training modules in clinical settings throughout low- and middle-income countries.

Once the initial development of the training module is complete, developers will build an evaluation package that researchers will use to evaluate the effectiveness of the training module in real-world settings.

Step 12: Define the Study Group

Create a document for the evidence package that includes a clear description of the target learner and their prerequisites language proficiency, previous clinical training or practice, and the ability, time, and resources to engage with the material independently.

Learners who have previously performed the targeted skill clinically should be excluded from the study group.

Provide the target number of learners to be enrolled in the study.

Step 13: Define the Self-training Period

Define the period of time and conditions required for the target learner to independently engage with the training module.

Consider the following when defining the self-training period:

1. time required of a learner to construct their own simulator using the build instructions; and
2. time required to complete the training module as developed.

Remember that, especially during an evaluation, the learner will only receive guidance from the training module, and not from an external instructor.

Learners may request assistance in finding or accessing module material, finding local sources for materials, or help with necessary apps that cannot be downloaded.

Learners may be provided with a stipend during this period to allow time for self-study and reimbursement for out of pocket simulator materials. Instruments and equipment may be loaned to study participants.

Learners must build the simulator themselves.

Step 14: Develop a Pre-clinical & Post-clinical Confidence Assessment

Build an self-administered assessment that measures the learner's confidence in their readiness to transition to the next step of the evaluation process. This is a pre-clinical and post-clinical assessment.

This confidence assessment could be a survey, rubric, or checklist that the learner can self-administer.

The learner uses the pre-clinical assessment to determine if they're ready for the next phase.

The learner uses the post-clinical assessment to determine their confidence performing future procedures.

Step 15: Develop a Clinical Readiness Exam

Using the results from self-administered skills assessment testing and contextual knowledge testing, create an exam to be administered to learners by third-party principal investigators at the testing site.

This exam evaluates whether the enrolled learner has fully engraged with the SELF module and completed the necessary materials to be considered fully self-taught to the point of competence.

At the clinical site where the learner's clinical evaluation will be performed, the evaluators will administer a Clinical Readiness Exam to progress to clinical assessment. This may be simulation based, questionnaire based, or use another instrument of the team's choosing for assessment. Learners may fail out of the protocol at this point and continue with traditional instruction if the evaluators deem it is not safe for the learner to proceed to clinical assessment.

Step 16: Develop a Case Report Form

Select a global assessment method, such as OSATS or SIMPL, to serve as a case report form. The form enables clinical sites to record a learner's clinical competence during their first clinical cases after completing a SELF training module.

Step 17: Register SELF Training Module with Community of Practice

When all preceding steps have been completed, register your SELF training module with the SELF Community of Practice.

Registration indicates that the training module is ready for evaluation by researchers at clinical evaluation sites.

Registration includes uploading all evidence from initial evaluation, the third-party evidence package, links to the publicly available training module, and data fields for your clinical readiness exam and case report form.

Developer Resources

Community of Practice

The SELF Community of Practice is a global network aimed at supporting the development and dissemination of innovative, cost-effective, and scalable procedural training modules.

Developers are members of the SELF Community of Practice. They should consider the Community of Practice to be an extension of their development team, especially when advice, technical support, and/or testing is needed.

The Community of Practice convenes in three ways:

1. Discussion boards
2. Online meetings
3. SELF Symposium

→ Access the SELF Community of Practice on SURGhub ←

Financial Support

Intuitive Foundation provides grant funding for the development of SELF training modules through the *Clinical Skills Training Grant*.

Additional financial support will become available as the SELF Community of Practice continues to grow.

Receiving a grant is not a requirement for developing a SELF training module. Anyone can develop a SELF training module.

Developer teams can be any organisation type – formal or informal.

Non-financial Support

In addition to financial support, developers have access to a comprehensive set of guides, templates, and other resources. These resources are designed to support the development of effective training modules.

Developer Toolbox

Developers have access to tools for building their training modules. These include a comprehensive library of guides and digital tools, a unique assessment platform called ENTRUST, and as well as access to more than a dozen existing skills training modules.

Developers can access these tools through the SELF Community of Practice on SURGhub.

Mentorship Program

Many developers have access to a dedicated Mentorship Manager to connect developers with trusted consultants that can provide technical support on various aspects of the content development process. Consultants have advanced knowledge of the SELF program and are equipped to advise on a wide range of technical issues.

How to Apply for Grant Funding

Intuitive Foundation provides grant funding to training module developers through the Clinical Skills Training Grant.

The grant supports the adaptation and expansion of existing clinical skills training content so that it is publicly available and free-to-use. This grant program provides financial support for non-profit organisations and academic institutions to edit, improve, and publish existing clinical skills training content. Such content will enable health care workers to independently learn, practice, and self-assess specific clinical procedural skills.

Developing a Proposal

The Intuitive Foundation seeks proposals from multidisciplinary teams that can collaboratively create new procedural skills training modules for anyone to learn a new surgical skill regardless of where they are in the world or where they are in their career.

The Intuitive Foundation invites individuals and teams to propose new and innovative approaches to training and self-administered skills assessment in line with our framework or adapt and improve existing training materials.

Prospective grantees should highlight elements of procedures that are either technically complex for surgical practitioners or are infrequent enough that surgical practitioners rarely have the opportunity to apply them. Both types of procedures can result in an increased risk of patient mortality, which shows the importance and urgency of SELF's mission.

When considering which procedural skills to target through training, prospective grantees should identify skills that are complex enough to require physical simulations. Modules should focus on the acquisition and development of one or more psychomotor skills needed to deliver a critical step of a specific surgical procedure. Learners should already possess basic surgical training, so training modules should go beyond fundamental skills.

The Intuitive Foundation encourages innovative proposals that use technology without the need for a high level of digital connectivity. For example, one training module on Appropedia includes a low-cost, easy-to-build cardboard

box simulation. All information about the build and its training components must be freely available to users through Appropedia.

Grantees should use their grant to develop an initial prototype as well as implement and/or improve upon an appropriate self-administered skills assessment framework. They should be prepared to iterate, test, and improve their initial prototype so that future learners are able to practise with a well-designed simulation.

Grantees will be selected on the basis of how well they address the problem statement. The problem statement is our call to action to grantees, and it articulates SELF's aims and what we expect grantees to deliver:

SELF aims to enhance training for surgical practitioners in resource-constrained settings through the creation of innovative surgical training modules that allow anyone, anywhere, and at any point in their career to learn a new surgical skill.

Grantees who create modules as part of SELF will make the training content freely available for use on Appropedia. This includes the informational content, instructions for building a training simulation, and the self-administered assessment for learners. Grants of up to $75,000 may be given to fund development of prototypes.

Eligibility Criteria

1. Grantees must be a non-profit organisation or academic institution.
2. Proposal must designate a principal investigator who is from and/or based in a low- or middle-income country as defined by the World Bank.
3. Training materials developed through SELF must be publicly available and free-to-use on Appropedia, an open-source platform based on MediaWiki tools.
4. The total cost for any grant may not include more than 20% indirect costs.

Grantee Expectations

Grantees will be expected to use all funding received for the purposes of developing the proposed training module. Examples include the following:

1. developing or testing the training;

2. costs for staff working on your training; and/or
3. engaging external expertise or advice.

Grantees will be expected to participate fully in specific workshops and other activities designed to support appropriate development of training materials.

Grantees are expected to complete their activities within 18 months.

Submitting Your Proposal

Prospective grantees must submit a proposal online via the Intuitive Foundation's grant website.

An evaluation committee will review proposals on a quarterly basis. Prospective grantees who submit their proposals during the final week of a quarter will be included in the following quarter for review. Prospective grantees will receive notifications on the status of an award after the committee has completed their quarterly review. Grant funding will be available after the execution of a grant agreement.

Evaluation Criteria

This section outlines the criteria that our evaluators will use to assess grant proposals. There are eight evaluation criteria, and the information provided below will help you understand what the evaluators will be looking for when making their decisions:

- clarity of goals and objectives;
- filling an unmet need;
- evidence that the existing skills training content can teach skills when administered in a traditional teaching environment;
- evidence that the submitting team has the clinical, technical, and educational knowledge and experience needed to develop quality training content;
- estimated outcomes and impact of increasing the proposed procedure or skill on the health of the patient population in low- and middle-income countries;

- global accessibility and buildability of any physical tools and/or simulators that are required for skill acquisition;
- quality and appropriateness of the self-assessment skills framework being proposed; and
- appropriateness of the proposal's defined scope, timeline, and budget.

Pre-application Checklist

This section lists many of the requirements to consider when developing a proposal.

Successful proposals will:

- ☐ Designate a principal investigator who is from and/or based in a low- or middle-income country as defined by the World Bank.
- ☐ Be led by a non-profit organisation or academic institution.
- ☐ Make training materials publicly available and free-to-use.
- ☐ Limit indirect costs to 20% or less (max of US$15,000)
- ☐ Develop training content that will be self-administered by learners.
- ☐ Create simulators that use low-cost materials that are commonly available in resource-constrained settings.
- ☐ Emphasise psychomotor skill development.
- ☐ Target skills that are either technically complex and/or are called upon infrequently enough that surgical practitioners rarely have the opportunity to apply th

Introduction to SELF

About the Surgical Education Learners Forum

In resource-constrained environments around the world, many surgical practitioners are unable to access simulation-based training. Due to a lack of access to cadavers, animal models, or simulation-based training, many surgical practitioners undertake procedures without sufficient experience.

The Surgical Education Learners Forum (SELF) aims to address the need for more effective simulation-based training.

SELF supports the development and evaluation of low-cost procedural skills training modules. These training modules enable psychomotor skills acquisition with practice on a build-it-yourself physical simulator made from inexpensive, locally available materials. The modules also include structured opportunities for self-administered skills assessment — a learning method that allows people to independently determine whether they have appropriately learned a skill or attained certain knowledge. These SELF training modules allow learners to independently practise psychomotor skills to competency without leaving their local healthcare facility.

SELF aims to create a paradigm shift in surgical training. Through SELF's training modules, surgical practitioners will have access to open-source educational resources, assessment tools, and effective simulators designed by the leading practitioners in their region.

About the Global Surgical Training Challenge

In 2020, the Intuitive Foundation created the Global Surgical Training Challenge to address the need for accessible and simulation-based surgical training through open-source training modules. Through the challenge, interdisciplinary teams from around the world designed and tested training modules for use in resource-constrained settings. Teams have empowered surgical practitioners through our new paradigm of combining open-source learning procedures and skills with self-administered skills assessment frameworks.

Through self-administered skills assessment frameworks, each surgical practitioner has the ability to measure their own proficiency and confidence when applying their newly-learned skills. This approach to skill-acquisition contrasts the traditional apprenticeship model of surgical training, which requires learners to "see one, do one, teach one." Instead, SELF is re-imagining this sequence as "see one, *teach yourself one,* do one."

As of May 2024, the Intuitive Foundation has supported the development of fifteen procedural skill training modules, as well as extensive integrated skills curricula for pre-hospital and emergency trauma management. SELF continues to fund the development of additional training modules.

About the SELF Community of Practice

The SELF Community of Practice is a group of global leaders who are engaged in the mission to bring procedural skills training to the point of care. These leaders include training module developers, surgical practitioners, learners, researchers, and subject matter experts.

The Community of Practice shares a mission to accelerate progress towards a future where high-quality procedural skills training is universal.

Organised by the Royal College of Surgeons in Ireland (RCSI), the SELF Community of Practice includes the following:

1. a library of static resources about procedural skills training;
2. online discussion forum to help members communicate and connect; and
3. online meetings for members to share their work and ideas.

The SELF Community of Practice uses a digital community platform that is hosted within the UN Global Surgery Learning Hub (SURGhub) and managed by the Royal College of Surgeons Ireland (RCSI).

→ **Access the SELF Community of Practice on SURGhub** ←

About the SELF Symposium

The SELF Symposium is a gathering of leaders aimed at accelerating progress towards a world where high-quality procedural skills training is universal. The first SELF Symposium occurred in California, USA, on August 21-23, 2023. In 2024, the SELF Symposium takes place in Kuala Lumpur, Malaysia, on August 29-30, during International Surgical Week.

2023 SELF Symposium

This three-day in-person event brought together many of the leaders involved with the Global Surgical Training Challenge, along with other participants who worked together to build consensus on fundamental concepts and priorities involved with scaling procedural skills training. Key topics included self-administered skills assessment, simulator fidelity, accessibility of digital platforms, procedure prioritisation, evidence generation, and a roadmap for SELF.

Each day was organised into several working sessions that addressed key topic areas for scaling procedural skills training, concluding with a session to explore the barriers associated with implementing this new training paradigm.

Participants rigorously prioritised concepts using sophisticated consensus techniques. The event created a high volume of data about the participants' viewpoints on these key topics.

The 2023 SELF Symposium created expert recommendations for *you* to use when developing a SELF training module. These recommendations are being refined and turned into resources, including the following:

1. Evidence checklist
2. Self-administered skills assessment checklist
3. Simulator task deconstruction checklist
4. Developer platforms checklist

More information about these recommendations and checklists is included within this handbook, as well as in a suite of articles that will be submitted for publication in 2024.

About Appropedia

Appropedia is an open-source platform. It is also a wiki, which is a type of website that allows anyone to add and edit content.

SELF training modules are publicly and freely available for people to access, modify, and share.

Appropedia is the central library for all SELF training modules. It provides a single access point for learners to browse and access training modules.

All SELF training modules **must** include a basic page on Appropieda that allows learners to learn about and access the training. Beyond this basic page, developers can choose to create their entire SELF training module on Appropedia and/or another learning platform.

The developer platforms checklist provides guidelines for selecting learning platforms that suit the needs of learners in resource-constrained environments.

Our Vision & Strategy

SELF is a community of practice that aims to accelerate progress towards a future where access to high-quality procedural skills training is universal.

Our community is motivated to address the needs of an estimated 4.8 billion people who lack access to timely, safe, and affordable surgical and anaesthesia care. At the core of this issue is the lack of trained surgical practitioners.

Surgical practitioners in a wide variety of environments need opportunities to learn and practise new procedural skills with minimal disruption from their daily clinical duties. Those in resource-constrained settings would particularly benefit from safe and cost-effective ways to expand their skill sets and integrate new tools and techniques into their practice.

SELF supports anaesthesia, critical care, nursing, and surgical providers in resource-constrained settings worldwide to create innovative, cost-effective, and scalable training solutions.

Procedural skill training modules—known as SELF training modules—are expected to accelerate, support, and increase the skills of surgical practitioners worldwide. These training modules are designed so that clinicians can train themselves on both simple and complex psychomotor skills—those that require combined coordinated physical movements and cognitive decision-making. Importantly, practitioners must be able to train at their local site of practice, on their own time, and without the need for a physically-present instructor.

By enabling independent skill acquisition through cost-effective and safe skills training, SELF modules have the potential to improve the capacity of the health workforce to meet unmet patient needs.

Glossary

This glossary defines important terms used in this handbook.

Developer

An individual or organisation who conceptualises, prototypes, tests, and/or improves procedural skills training modules.

Learner

Someone who is engaged in the process of acquiring new knowledge, skills, or abilities. Also known as a *student*, *trainee*, or *practitioner*.

Low- and middle-income country (LMIC)

An economic classification based on a country's gross national income per capita. For 2024, the World Bank classified low-and middle-income countries as those with a gross national income per capita of less than US$ 13,845. A full listing of LMICs is available on the World Development Indicators website.

Resource-constrained environment

A location in which effective health care services are constrained by issues such as:

a) limited access to medication, equipment, supplies, and devices;
b) unreliable electrical power, transportation, and built environments;
c) insufficient number and training of health care workers;
d) limited access to adequate maintenance and parts; and/or
e) insufficient funding overall.

Also known as a *low-resource setting/context/environment.*

Open-source

A publicly and freely available resource for people to access, modify, and share.

Psychomotor skills

Skills that require combined coordinated physical movements and cognitive decision-making. Psychomotor learning is demonstrated through physical skills including movement, coordination, manipulation, dexterity, grace, strength, and speed. These actions demonstrate fine or gross motor skills, which are desired for using precision instruments during surgery.

SELF training module

A procedural skills training module that is designed for clinicians to train themselves on psychomotor skills that require combined coordinated physical movements and cognitive decision-making.

Clinicians must be able to train at their local site of practice, on their own time, and without the need for a physically-present instructor.

Self-administered skills assessment (SASA)

A learning method that supports deliberate practice with targeted, formative feedback on the physical execution of a skill. A self-administered skills assessment allows learners to develop the self-confidence and competence needed to transfer their newly acquired skills safely into clinical practice.

A self-administered skills assessment (SASA) framework is a tool that allows learners to recognize whether they have successfully acquired a skill.

Self-directed learning

Education without direct guidance from teachers or schools. Self-directed learning allows people to choose the subject, form, method, place, and timing of their education. Also referred to as *autodidacticism*, *self-education*, *self-learning*, and *self-teaching.*

Simulation-based training

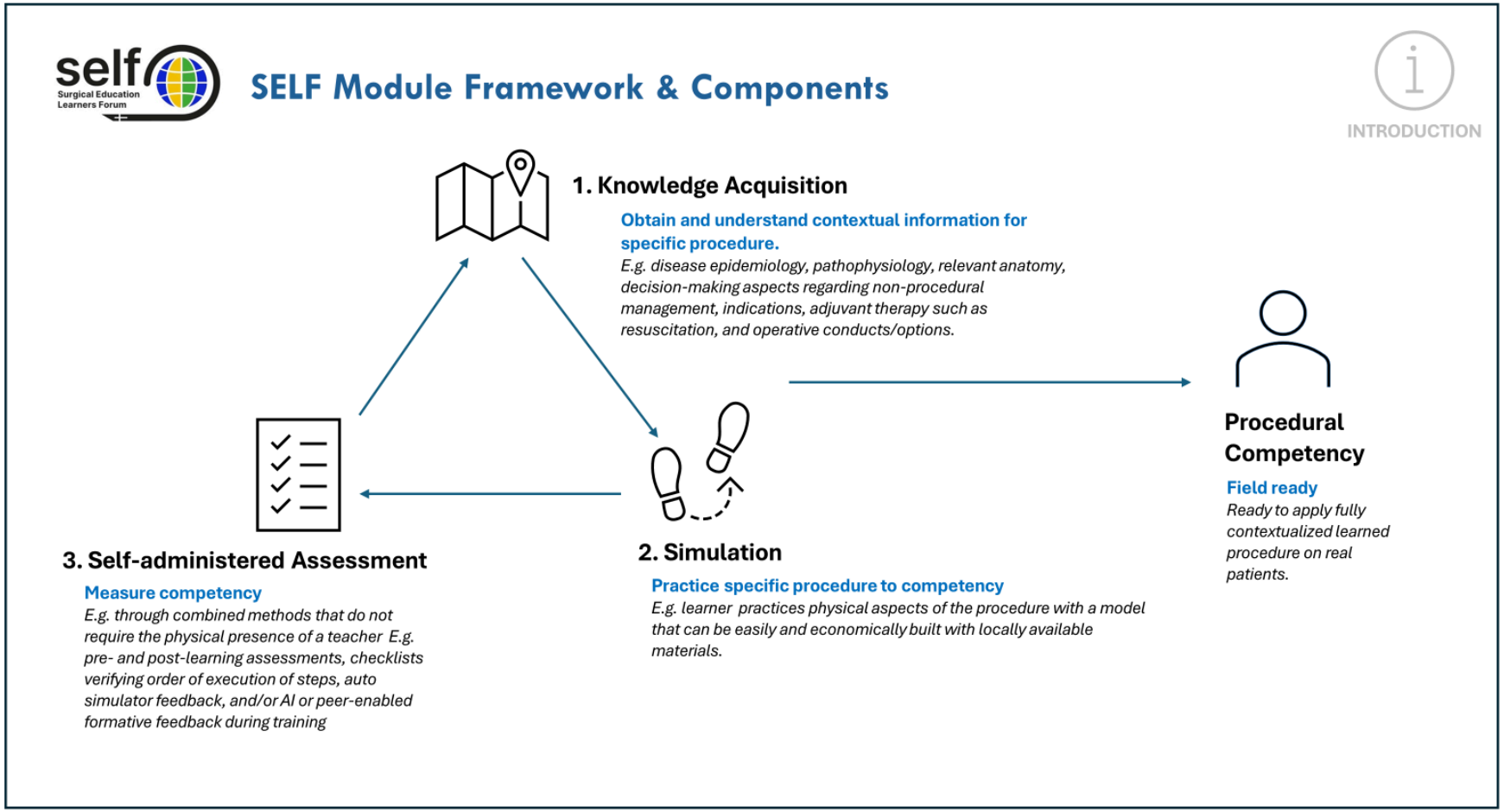
Involves the use of equipment or computer software to model a real-world scenario. During a simulation-based training, the learner is taught how to perform tasks or activities in a real-world scenario so they will be better prepared should the event actually occur.

Surgical practitioner

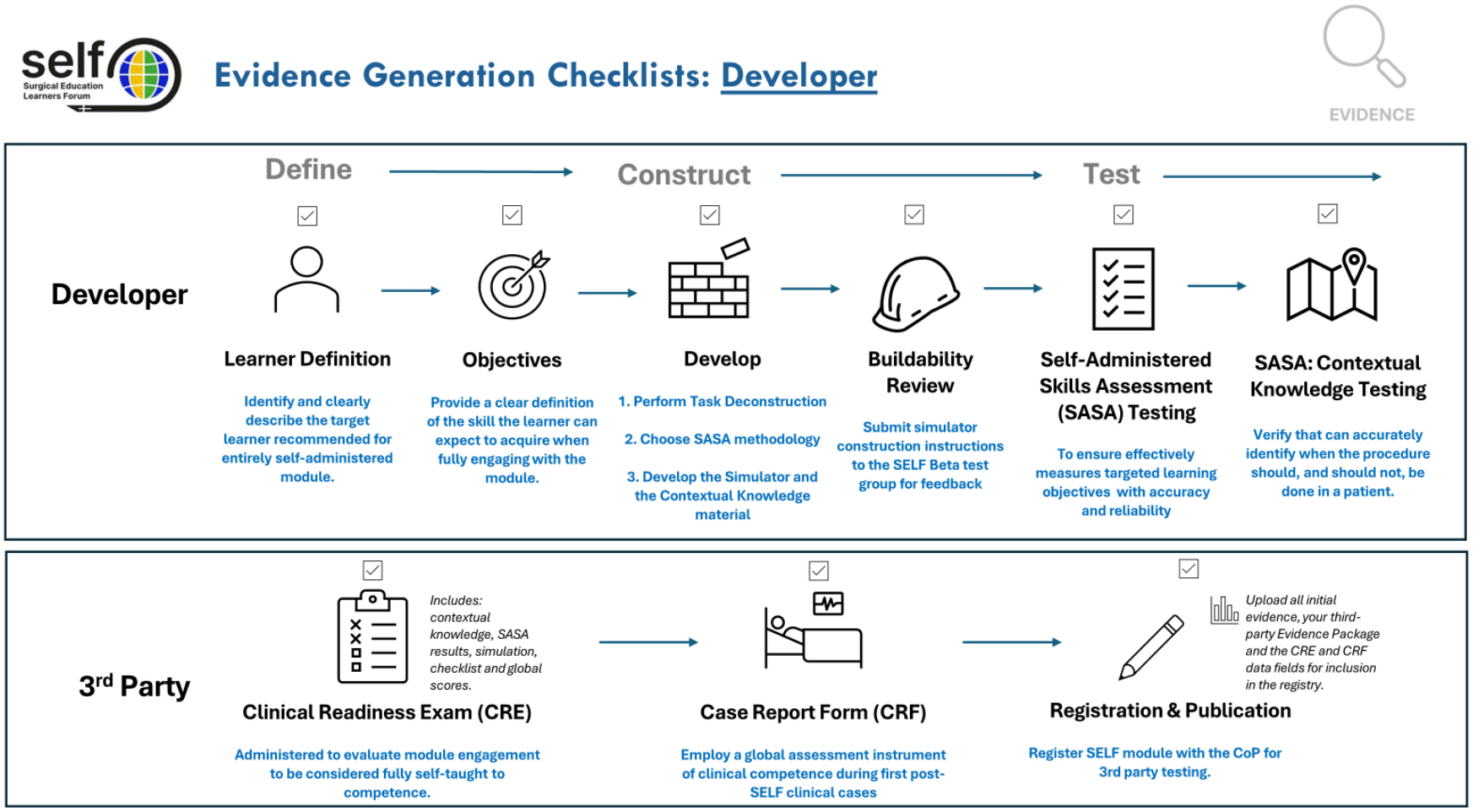
A key medical role involved in surgery such as a surgeon, anesthesiologist, midwife, clinical officer, nurse, or student. Surgical practitioners perform surgery both formally — as part of an official scope of practice — and by necessity.

Appendix

SELF Training Module Framework Summary (June 30, 2024)



Evidence Summary (June 30, 2024)



Evidence Checklist (June 30, 2024)

These checklists are designed to be used by developers of SELF modules while developing their module and then for creating the "Evidence Generation Package" for third-party testing of their module including the necessary framework and documentation for inclusion in data registries.

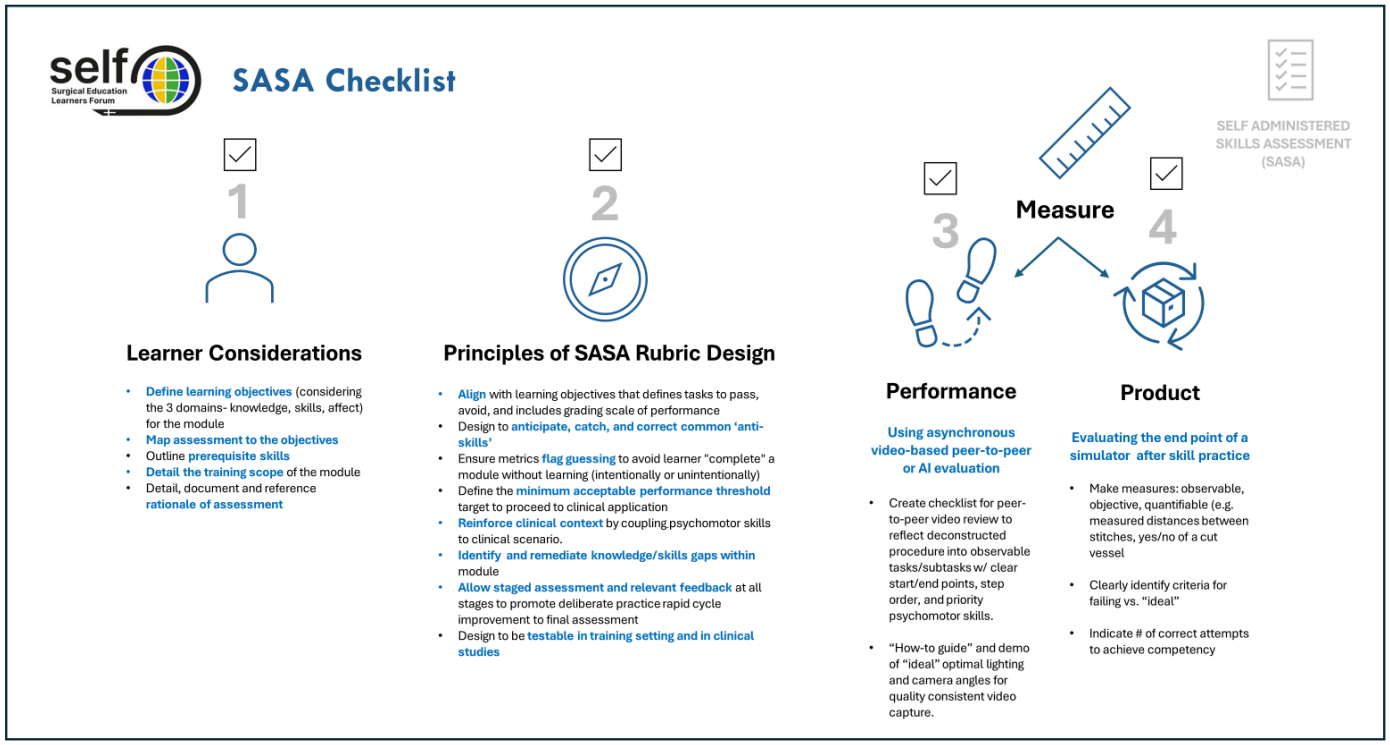
Module Developer Initial Evidence Checklist

- ☐ **Learner Definition.** For each complete SELF module, identify and clearly describe the minimum experience and setting capability of the target learner group that is recommended for engaging with the material in an entirely self-administered fashion. e.g. "postgraduate medical officers and surgeons in district hospitals capable of general anaesthesia supported surgical procedures"
- ☐ **Training Module Objectives.** Provide a clear definition of the skill the learner can expect to acquire when fully engaging with the module.
- ☐ **Module Development.** Perform Task deconstruction, choose an appropriate self-assessment methodology, and develop the Simulator and the Contextual Knowledge material[1]
- ☐ **Simulator Buildability Review.** During development of the physical simulator, submit simulator construction instructions to the SELF Beta test group for feedback. Iterate as necessary for clarity of build directions and buildability of simulator
- ☐ **Self-Administered Assessment Testing.** As part of the development of the self-administered assessment framework test to ensure all assessments effectively measure targeted learning objectives with high accuracy and reliability, acting as an adequate substitute for in-person educator feedback.[2]
- ☐ **Contextual Knowledge Testing.** Verify that learners completing the knowledge/contextual portion of the training with the module can accurately identify when the procedure should, and should not, be done in a patient.

Third-Party SELF Evidence Generation Package

- ☐ **Clinical Readiness Exam (CRE).** [MK6] Using the results from your development testing, create an exam to be administered to learners by third-party Principal Investigators at the testing site. This exam evaluates whether the enrolled learner has fully engaged with the SELF module and completed the necessary materials to be considered fully self-taught to the point of competence. Include elements of contextual knowledge with a review of the self-administered assessment tests results, and procedural performance on the simulator and review of checklist and global scores.
- ☐ **Case Report Form (CRF).** [MK7] Employ a global assessment (e.g. OSATS (REF[DR8]), SIMPL (REF)) instrument or equivalent for the PIs to ensure and record the clinical competence of the learner during their first clinical cases after SELF training.
- ☐ **Registration and Publication.** When all of the initial evidence testing has been adequately performed, register your SELF module with the Community of Practice for 3rd party testing. This includes uploading all initial evidence, your third-party Evidence Package and the data fields for your CREs and CRFs for inclusion in the registry.

Self-Administered Skills Assessment Summary (Updated June 30, 2024)



Self-Administered Skills Assessment Checklist (Updated June 30, 2024)

This checklist is designed to be used by developers of SELF modules for creating and deploying effective self-administered assessment frameworks for SELF modules aimed at teaching clinical psychomotor skills i.e. skills that require combined coordinated physical movements and cognitive decision-making.

Learner considerations

- ➢ Define the learning objectives (considering the 3 domains- knowledge, skills, affect) for the module
- ➢ Outline for the learner how the assessment maps to the learning objectives
- ➢ Outline the expected prerequisite learner skills and presumed setting and describe the scope of what the simulator is designed to teach
- ➢ Show, document, and reference the rationale behind the components of the assessment

Principles of Self-administered skills assessment

- Create an assessment rubric that aligns with learning objectives that define tasks necessary to pass, elements that must be avoided, and includes objective grading scale of skills performance
- Design the assessment to anticipate, catch, and correct common 'anti-skills' (poor techniques acquired on simulators which need to be unlearned when applying them clinically) [ref fidelity article][7]
- Test to ensure metrics are not subject to guessing strategies to avoid learner "completing" a module without learning (intentionally or unintentionally)
- Clearly define the minimum acceptable threshold of performance and a comfortable target for the learner to aim for before proceeding to clinical application
- Ensure clinical relevance by coupling the psychomotor skill to clinical scenario-based content. Reinforce the clinical context of the skill while it is being practised
- Include materials designed to support the user's identification of gaps in their knowledge and skill[2] and to promote focused, deliberate practice to address these gaps
- Allow low-stakes practice and rapid sub-analysis of portions of the skill, and progressive assessment and relevant feedback at all stages of skill acquisition which lead to final high-stakes "pass/remediate" assessment
- Design self-assessment methods[5] to be rigorously testable in training setting *and* in clinical studies

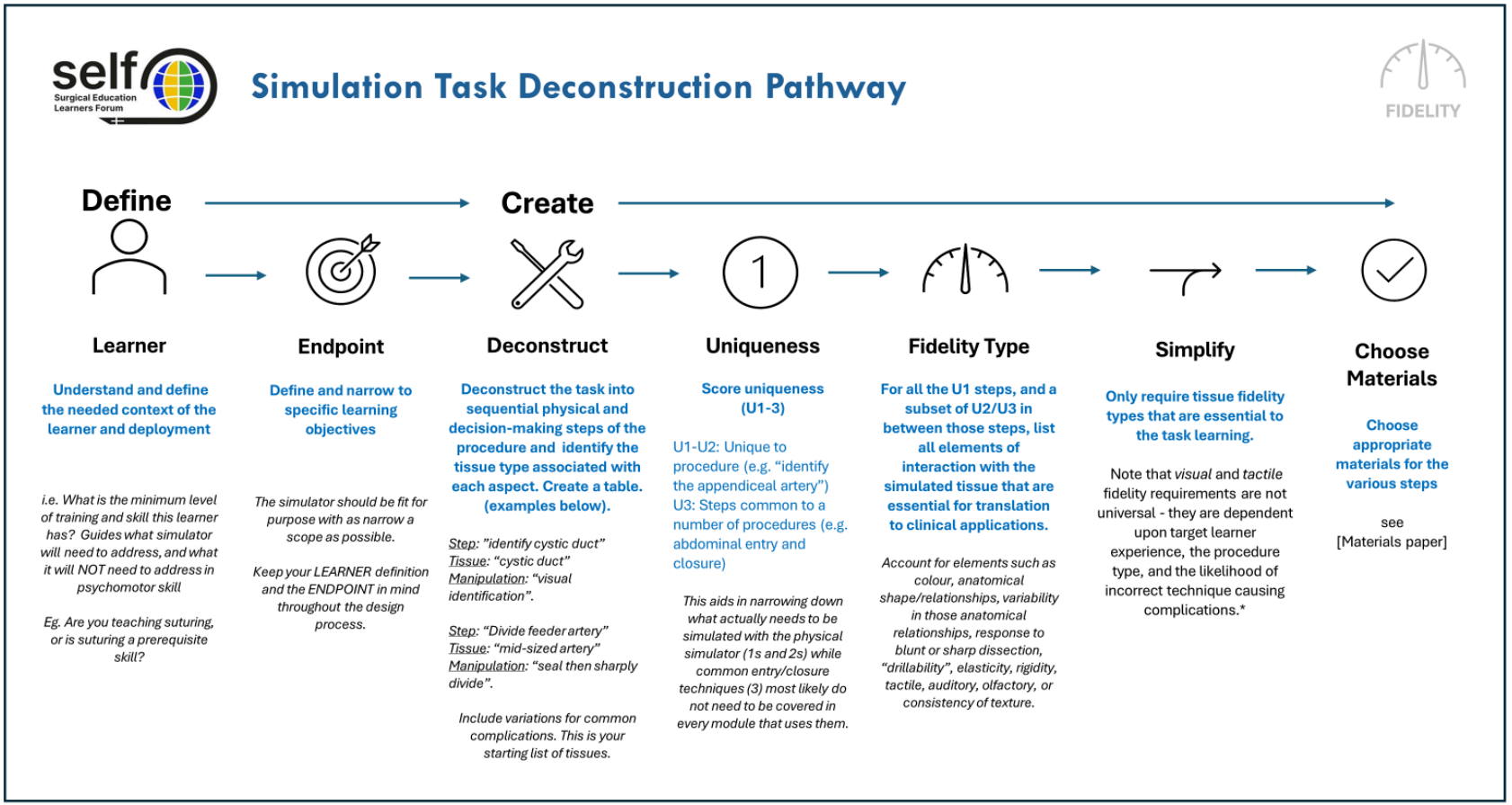
Assessment, Performance Measures (assessment using asynchronous video-based peer-to-peer or AI evaluation)

- Create a checklist for peer-to-peer video review. Checklist should reflect the procedure, deconstructed into *observable* tasks and, if necessary, subtasks that have easily identifiable start and end points, a defined order[6] and reflect the most important psychomotor skill/s.
- Determine sufficient lighting and appropriate camera angles for adequate quality video capture and provide the learner with instructions that might include a diagram of the field of view and/or plans for creating a camera stand for a phone as a video device, to ensure consistency for assessment reliability.
- In the training materials include video of "ideal" performance of the task on both the simulator *and in a patient* from the specified viewpoints and with the defined fields of view
- Capture the learners' videos and evaluations from reviewers for training and improving AI measurement methods.[8]

Assessment, Product Measures (assessment based on evaluating the end point of a simulator after skill practice)

- Make measures of the completed simulator observable, as objective and quantifiable as possible e.g. measured distances between stitches and size of bite or the yes/no presence or absence of a feature such as a cut vessel or a touched/injured structure under a drill hole. [11]
- Clearly identify the criteria for a failing variation in relation to "ideal" and indicate how many estimated times the task must be performed properly in a row before the learner's performance in that step is considered competent.

Simulator Task Deconstruction Summary (Updated June 30, 2024)



Simulator Task Deconstruction Checklist (Updated June 30, 2024)

This checklist is designed to be used by developers of SELF modules for deconstructing the psychomotor element of surgical tasks (i.e the key elements of the physical skill that is performed with integrated knowledge and feedback).

Before you Begin:

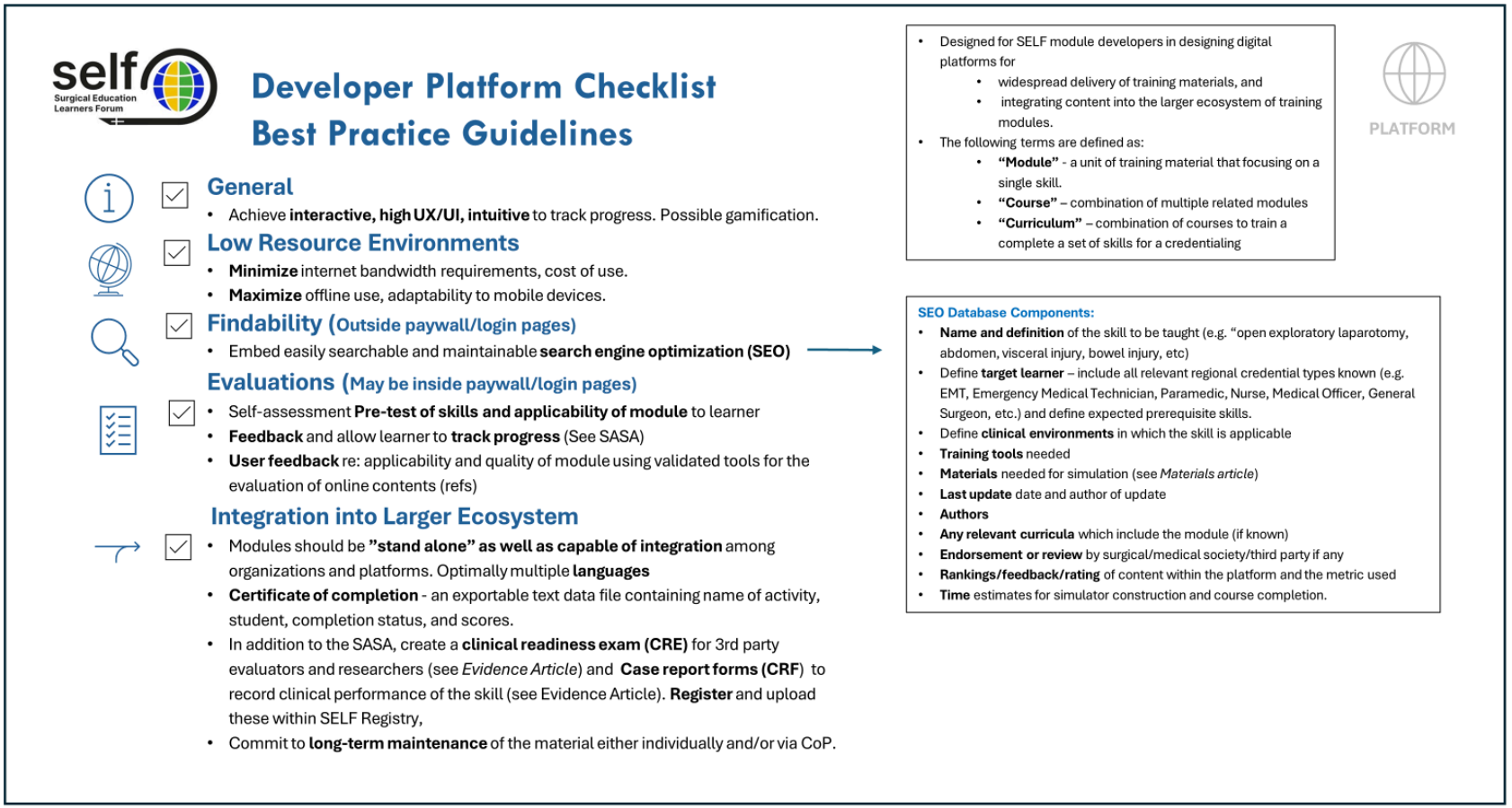
- ➔ **Define the Learner.** Understand and define the needed context of the learner and deployment i.e. what is the minimum level of training and skill this learner has? This is needed to determine what do you need to address, and what do you NOT need to address in terms of the learner's psychomotor skill such as: Are you teaching suturing, or is suturing a prerequisite skill?
- ➔ **Define the endpoint**. Considering where the learner is starting, define learning objectives and narrow down the scope of the expected simulator to *only* address those objectives. The simulator should be fit for purpose with as narrow a scope as possible.
- ➔ Keep your learner definition and the end goal in mind throughout the design process.

Creating the Framework:

- ➔ **Deconstruction.** Deconstruct the task into the sequential physical and decision-making steps within the procedure, identify the tissue type that this step interacts with, and lay it out in a table (example below). These should be at the level of single interactions with tissues such as Surgical step: "identify cystic duct" Tissue: "cystic duct" and Manipulation type: "visual identification". Surgical step: "Divide feeder artery" Tissue: "mid-sized artery" and Manipulation type: "seal then sharply divide". Include variations for common complications. This is your starting list of tissues.
- ➔ **Uniqueness.** Note whether each step is common to a large number of procedures. For example, "abdominal entry and closure" would be assigned a level "3", indicating it is unique to the procedure. "Identify the appendiceal artery" would be assigned a "1" to indicate that it is not unique to this procedure, or "2" to indicate somewhere in-between. This aids in narrowing down what actually needs to be simulated with the physical simulator. Common entry/closure techniques most likely do not need to be covered in every module that uses them.
- ➔ **Fidelity type.** Starting with the most unique steps (uniqueness level 3), list all the elements of the interaction with the simulated tissue which are essential for the learner to translate what they are learning over to clinical applications. Account for elements such as colour, anatomical shape/relationships, variability in those anatomical relationships, response to blunt or sharp dissection, "drillability", elasticity, rigidity, tactile, auditory, olfactory, or consistency of texture. Then fill in the lower priority level 1 or level 2 steps.
- ➔ **Simplify.** Only require a tissue fidelity type if it is *arguably necessary to the aspect of the task being learned*. Recognise that visual and tactile fidelity requirements are not universal – they are dependent upon target learner experience, the procedure type, and the likelihood of incorrect technique causing complications. For example, a more experienced learner may be able to suspend disbelief when a tissue has low tactile fidelity and learn an essential element of a surgical step from visual fidelity alone. Alternately, when the performance of the step is so dependent on the characteristics of the material (such as sewing bowel to pancreas) anything but identical physical characteristics is likely to have the clinician practising inappropriate techniques with potentially deadly consequences. Simplification after deconstruction serves to maximise cost-effectiveness and fidelity with minimal complexity while addressing the learning objective.
- ➔ **Choose Materials.** Use the deconstruction to choose appropriate materials for the various steps see [Materials paper].

Surgical Step	Tissue	Manipulation type	Uniqueness	Desired type of feedback to the learner	Fidelity Type
Step 1					
Step 2					
Step 3 ...					

Developer Platform Guidelines (Updated June 30, 2024)



Developer Platforms Checklist (Updated June 30, 2024)

This checklist is designed to be used by content developers of SELF modules for deciding on appropriate digital platforms for delivery for surgical training materials, and for integrating content into the larger ecosystem of training modules.

The following terms are defined as:

- ➔ A "module" is a unit of training material that focuses upon a single skill.
- ➔ Multiple related skill modules may be strung together create a "course", and
- ➔ A "curriculum" is a longer series of courses or modules intended to acquire a complete a set of skills necessary for a credential

Best practices (general):

- ➔ Provide an interactive, user-friendly, easy to navigate user interface that organises the skill modules on the platform in an intuitive way and helps users track progress.
- ➔ Explore strategies for driving engagement such as gamification on the platform.

Best practices for low resource environments:

- ➔ Minimise the required internet bandwidth to load the digital platform
- ➔ Design the platform to accommodate offline use after download of skill module content
- ➔ Ensure your chosen platform and content works on mobile devices (Android and iPhone)
- ➔ Minimise the cost to the learner for using the material on the platform

Best practices for integration of skill modules into the larger ecosystem:

- ➔ Allow entry and exit for a single skill module. Make your individual modules possible to be used in a stand-alone mode and incorporated into other organisation's curricula
- ➔ Upon completion of a skill module or course, generate a certificate of completion - an exportable and saveable text data file containing at least the name of the module or course, registered name of student, completion status, and relevant scores.
- ➔ Choose a platform which allows content to be available in multiple languages
- ➔ In addition to the self-administered assessment, create a clinical readiness exam for 3rd party evaluators and researchers (ref: Evidence)
- ➔ Create case report forms to record clinical performance of the skill (ref: Evidence)
- ➔ Register the skill module in the SELF Registry, upload the clinical readiness and case report forms
- ➔ Commit to long-term maintenance of the material, or make the content open source and easy for third parties to edit and keep up to date

Best practices for findability (outside of paywall/log-in pages)

Use a platform in which you can create searchable and easily maintainable search engine optimization (SEO) data fields. For each separate skill module create an SEO field containing the following data:

- ➔ Clear name and definition of the skill to be taught – include anatomical terms, alternate names for the procedure (e.g. "open exploratory laparotomy, abdomen, visceral injury, bowel injury, etc)
- ➔ Clear definitions of target learner – identify as many relevant regional credential types as known (e.g. EMT, Emergency Medical Technician, Paramedic, Nurse, Medical Officer, General Surgeon, etc.)
- ➔ Clear definitions of expected prerequisite skills and adjacent skills
- ➔ Clear definition of the clinical environments in which the skill is appropriate and applicable
- ➔ Listing of the tools needed for the procedure/training
- ➔ Listing of the materials needed for simulation if applicable (see Materials article)[44]
- ➔ Last update date and author of update
- ➔ Author names
- ➔ Name of known curricula which encompasses the individual module
- ➔ Surgical/medical society or third-party endorsements if any
- ➔ The results of rankings/feedback/rating of content within the platform and the metric used to generate them
- ➔ Estimated times for building the simulator and completing the course

Best practices for evaluations (may be inside paywall/log-in pages)

- ➔ Provide a pre-test for learner self-assessment of necessary skills and applicability of the skill module
- ➔ Provide feedback on knowledge and skill deficits and allow learner to track their progress (See Self-Administered Assessment article)[41]
- ➔ Solicit and record user feedback on applicability and quality of the material using validated tools for the evaluation of online contents such as the "Approved Instructional Resources" (AIR)[29] tool and the revised "Medical Education Translational Resources: Imp


self
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Learners Forum