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Some Critical Issues in School Mathematics and Science in SA

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Some “dashboard indicators” for judging quality of results

- The number of candidates passing
- The quality of the results
- The reliability of the predicative quality of the exam for performance at HE level
- The standard of the curriculum

Assumptions do affect our perceptions

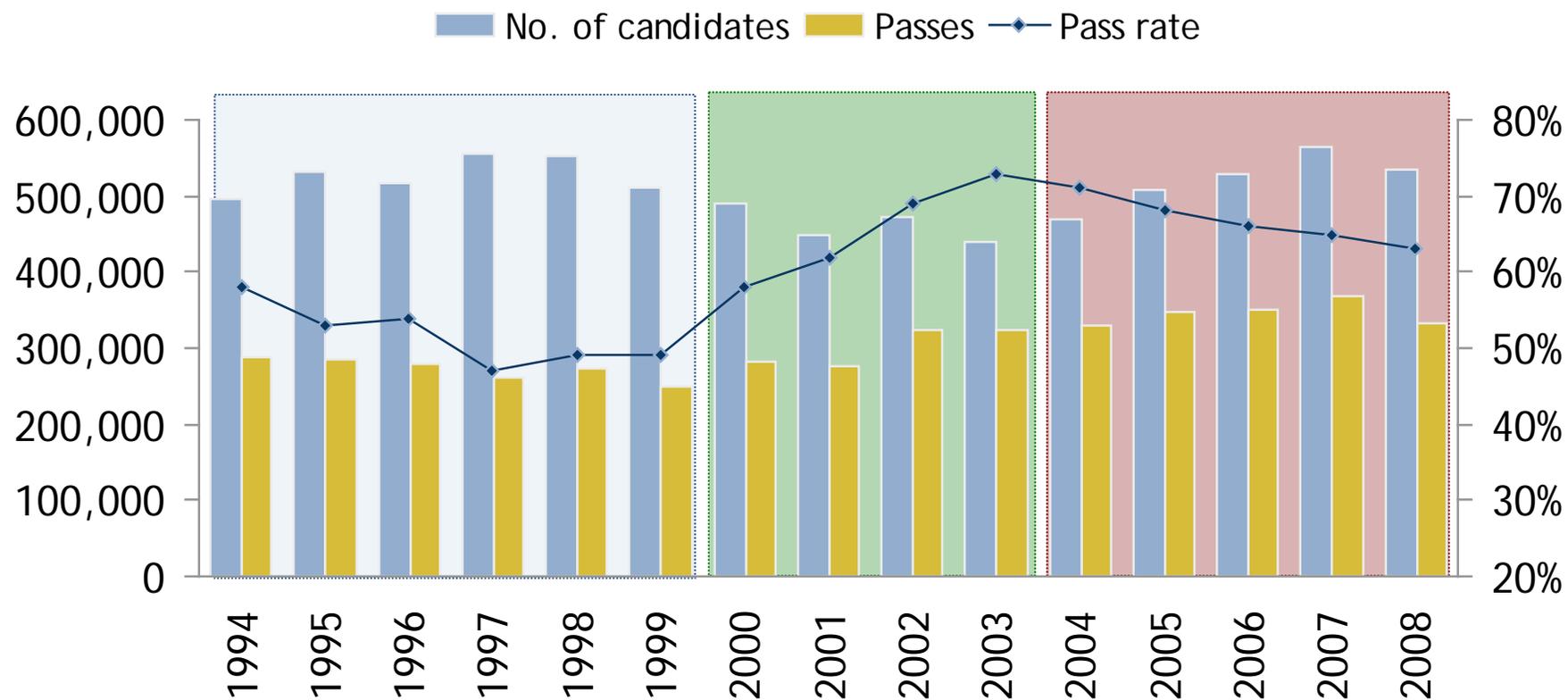
- One assumption that fuels skepticism is that
- “more means less” or
- “more means worse”

The number of candidates passing

- SA has seen a steady increase over the last decade in the number of learners who enrolled for and wrote the Senior Certificate
- Massification is a natural outcome of an education system that is non-racist, non-sexist and democratic
- The underlying philosophy of the NCS had been designed to ensure that most people achieve the minimum requirement for a pass

Senior Certificate examination results by era

Senior Certificate examination results, all schools, 1994-2008



Sources: DoE, 2004, 2005a, 2005b, 2005c, 2007, 2008, 2009

Predictive Quality of the Matric Results

- ❑ Long standing debate around whether the school leaving results are good predictors of academic achievement in HE.
- ❑ Historically the predictive quality of matriculation marks were reasonable predictors for white South Africans but less so for black South Africans.
- ❑ Impossible to be definitive about the predictive quality of the NCS after the first year of its implementation.

Implications of the 2008 NSC results for HE

- NSC examination was possibly harder for those at the bottom and softer for those at the top
- Need additional information to discriminate at the top end.
- However most candidates with “B” pass in NSC would have equivalency wrt cognitive demand and content knowledge of a SC candidate who obtained exemption pass in 2007.
- The NSC candidate also brings additional values, skills and attitudes.

The NCS philosophy

- The National Curriculum Statement represents different set of standards for all
- It reflects the new values embedded in the Constitution
- Also aims to develop learners who can respond to the growth and development of knowledge and technology and the demands of the 21st century

The design of the NCS

ASs

= leaves of the tree

LOs

= branches of the tree

COs and DOs

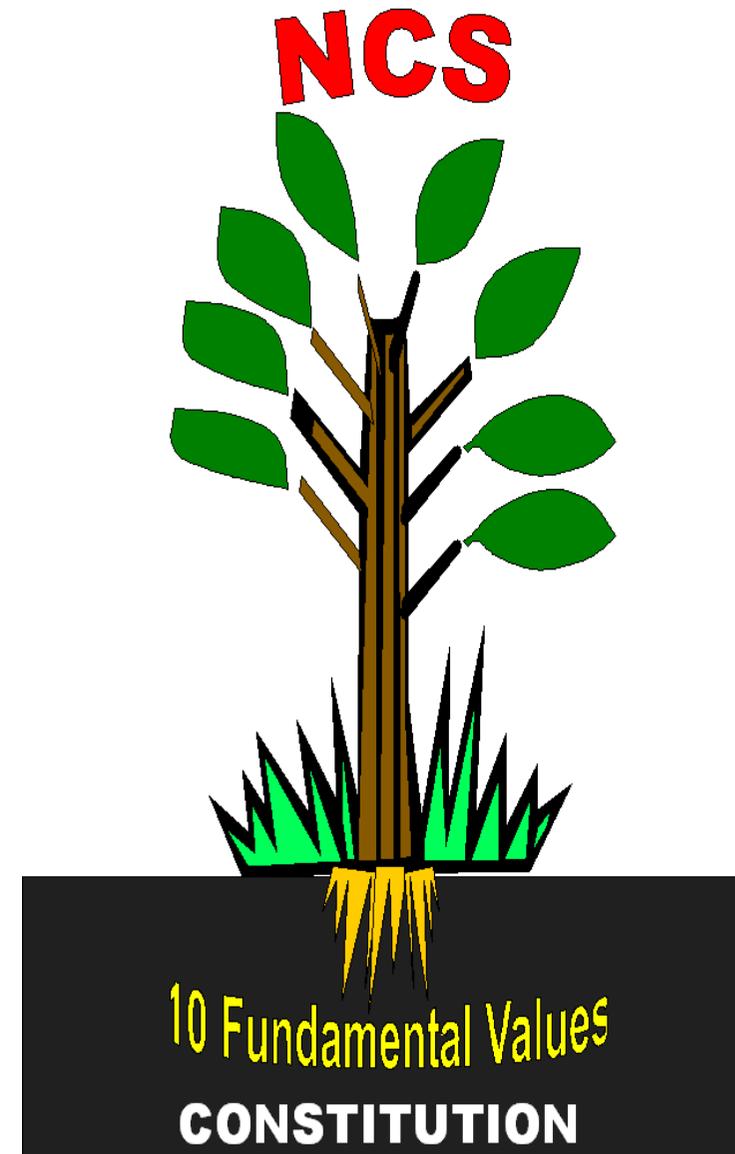
= trunk of the tree

10 FUNDAMENTAL VALUES =

roots of the tree

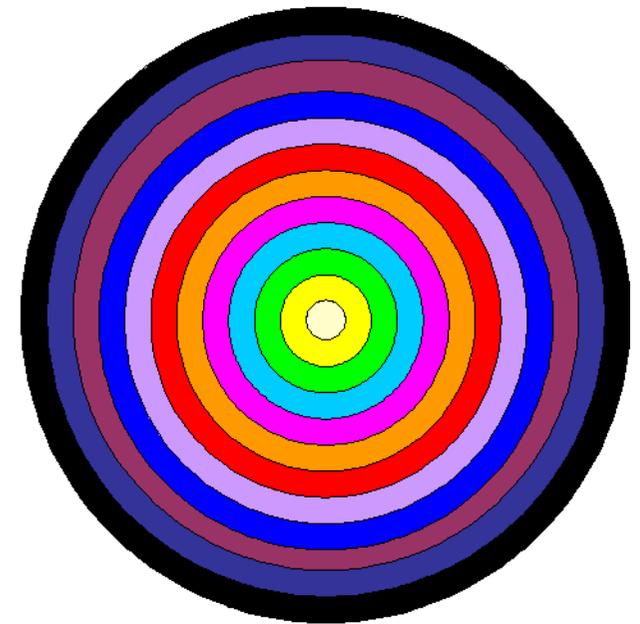
CONSTITUTION

= soil in which the Fundamental Values are grounded



Five critical and seven developmental outcomes

- Solve problems
- Work with others
- Manage self
- Communicate early
- Use science and technology
- Understand world as a set of related systems
- Strategies to learn
- Citizenship
- Cultural and aesthetic sensitivity
- Education and career opportunities
- Entrepreneurial opportunities



TRUNK OF THE TREE

The case of Mathematics

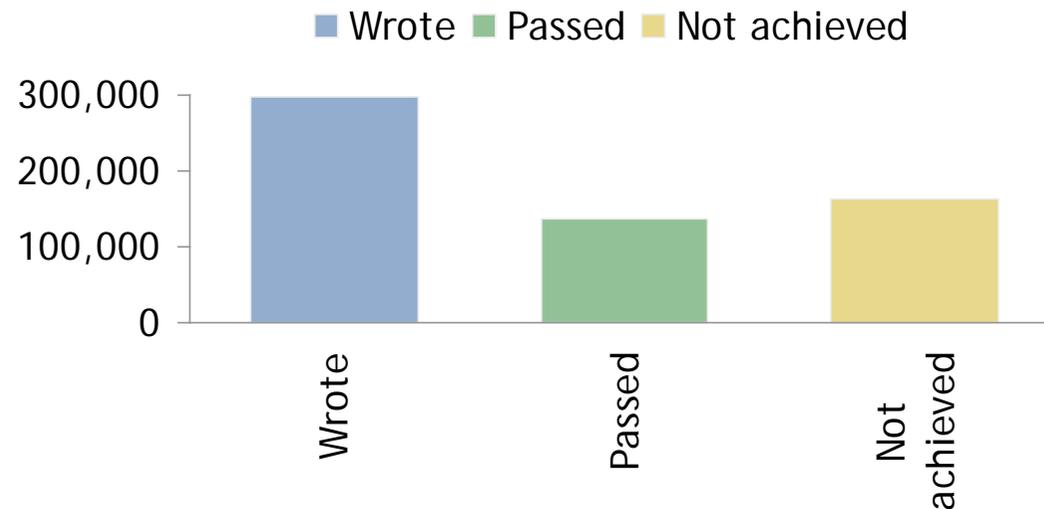
- Mathematics is continuously singled out in discussions on:
 - Curriculum reforms
 - Examination results
- Historically 30% to 40% of secondary schools in the country simply did not offer any mathematics beyond grade nine
- In 2008 all 590,000 learners took some form of mathematics

Mathematics and the Class of 2008

- The Class of 2008 had 63,038 learners who passed mathematics at the 50% level or higher
- This stands in contrast to the 25,000 who passed Higher Grade mathematics in 2007
- A further 207,230 learners passed mathematical literacy, most of whom would not have done any mathematics in the previous system. A total of 16,557 passed ML at the level of 80% or higher

Math pass rate

Number passing Math at different thresholds



	Wrote	Passed at 30%	Passed at 40%	Passed at 50%	Passed at 60%	Total did not pass
2008	298 821	136 503	89 788	63 038	42 323	162 318

Sources: DoE, Abdrdged Report on the 2008 NSC Examniation Results, December 2008; Doe, Technical Report - NSC, December 2008

Trends in HG Math pass rate

Number passing HG Math

Year	No. Wrote Math	No. Wrote Math HG	No. Passed Math HG
1995	200,000	60,000	29,000
1996	215,000	65,000	22,000
1997	231,000	68,000	20,000
1998	280,000	60,000	20,000
1999	281,000	50,000	20,000
2000	284,000	39,000	19,000
2001	264,000	35,000	20,000
2002	261,000	35,000	21,000
2003	258,000	36,000	23,000
2004	276,000	40,000	24,000

* Pass at 50% or higher

Sources: Vithal, 2008, Table constructed from data in CDE Research Report No 13; Kahn 2007, DoE Senior Certificate Technical Report 2006; DoE Senior Certificate Report 2007. Figures rounded off

Trends in HG Math pass rate

Number passing HG Math

Year	No. Wrote Math	No. Wrote Math HG	No. Passed Math HG
2004	276,000	40,000	24,000
2005	303,000	44,000	26,000
2006	318,000	47,000	25,000
2007	348,000	46,000	25,000
2008	533,000	298,821	63,038*

* Pass at 50% or higher

Strategy to Increase Learner Achievement

- Key challenge to *inspire* and *affirm* learners to engage with the subject and to include mathematical and scientific proficiency as part of a “possible self”
- Learners have to commit to extra time on task
- Provision of high quality learning resources

Basic indicators of quality in mathematics teaching

Quality of mathematical teaching depends on whether the teacher can:

- selective use cognitively demanding tasks
- plan the lesson by elaborating the mathematics that the learners must learn through those tasks
- allocate sufficient time for the learners to engage in and spend time on the tasks.

Five strands of mathematical proficiency

- **Conceptual understanding:** comprehension of mathematical concepts, operations, and relations
- **Procedural Fluency:** skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.
- **Strategic Competence:** ability to formulate, represent, and solve mathematical problems.
- **Adaptive reasoning:** capacity for logical thought, reflection, explanation, and justification
- **Productive disposition:** habitual inclination to see mathematics as sensible, useful and worthwhile, coupled with a belief in diligence and one's own efficacy.

Source: Jeremy Kilpatrick et.al.(2001) *Adding it Up: Helping Children to Learn Mathematics*

Professional Development of Teachers

Effective teachers of mathematics have:

- high expectations for all their learners
- inspire learners to value learning activities
- can interact with learners of different backgrounds and abilities
- can establish communities of learners

First stage of professional development of teachers

Teachers will be assisted in-context with:

- meticulous planning and preparation based on strong subject knowledge
- the logical and systematic construction of a lesson.
- core teaching skills such as questioning, exposition and illustration.
- the personal power and presence and leadership of the teacher.
- an understanding of the different modes of interaction between the teacher and the learner.
- participating in a community of practice.

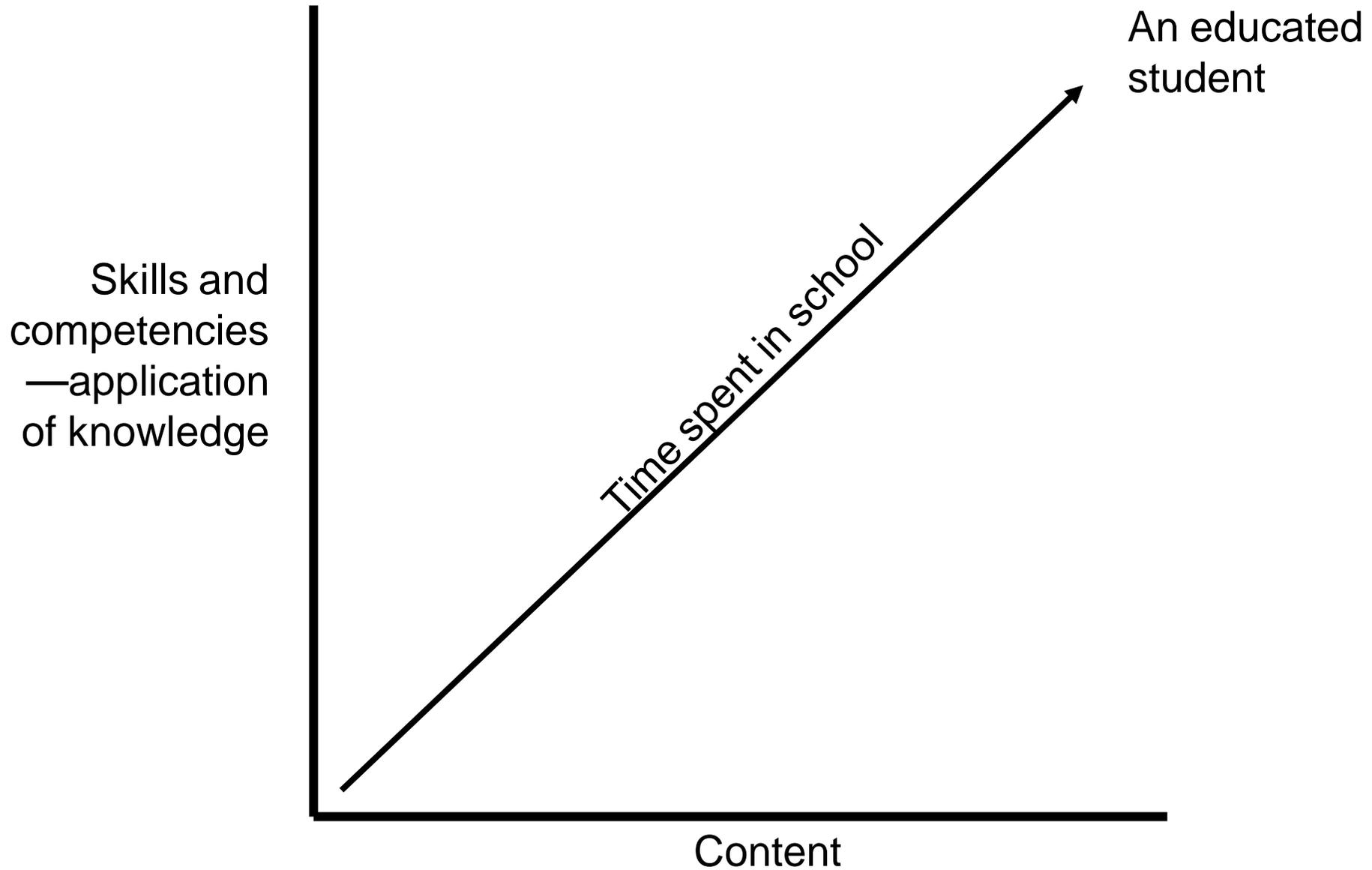


Fullan and Hargreaves (1992) points out that:

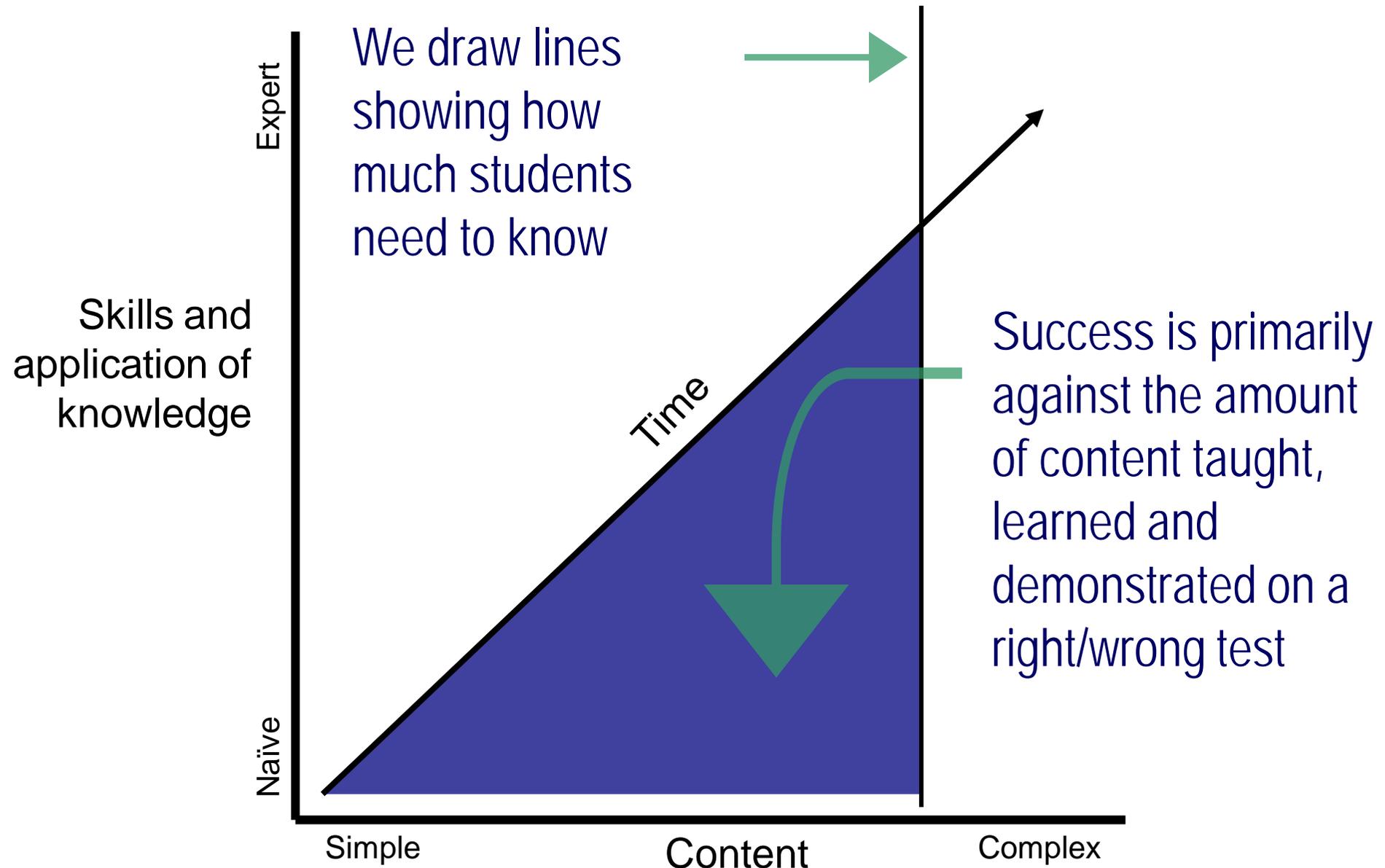
“ educational conservatism is sustained by uncertainty, isolation and individualism. When teachers are afraid to share ideas and successes for fear that others might steal these ideas or alternatively that they be perceived as blowing their own horns, we have reached a point where the school has institutionalised conservatism”

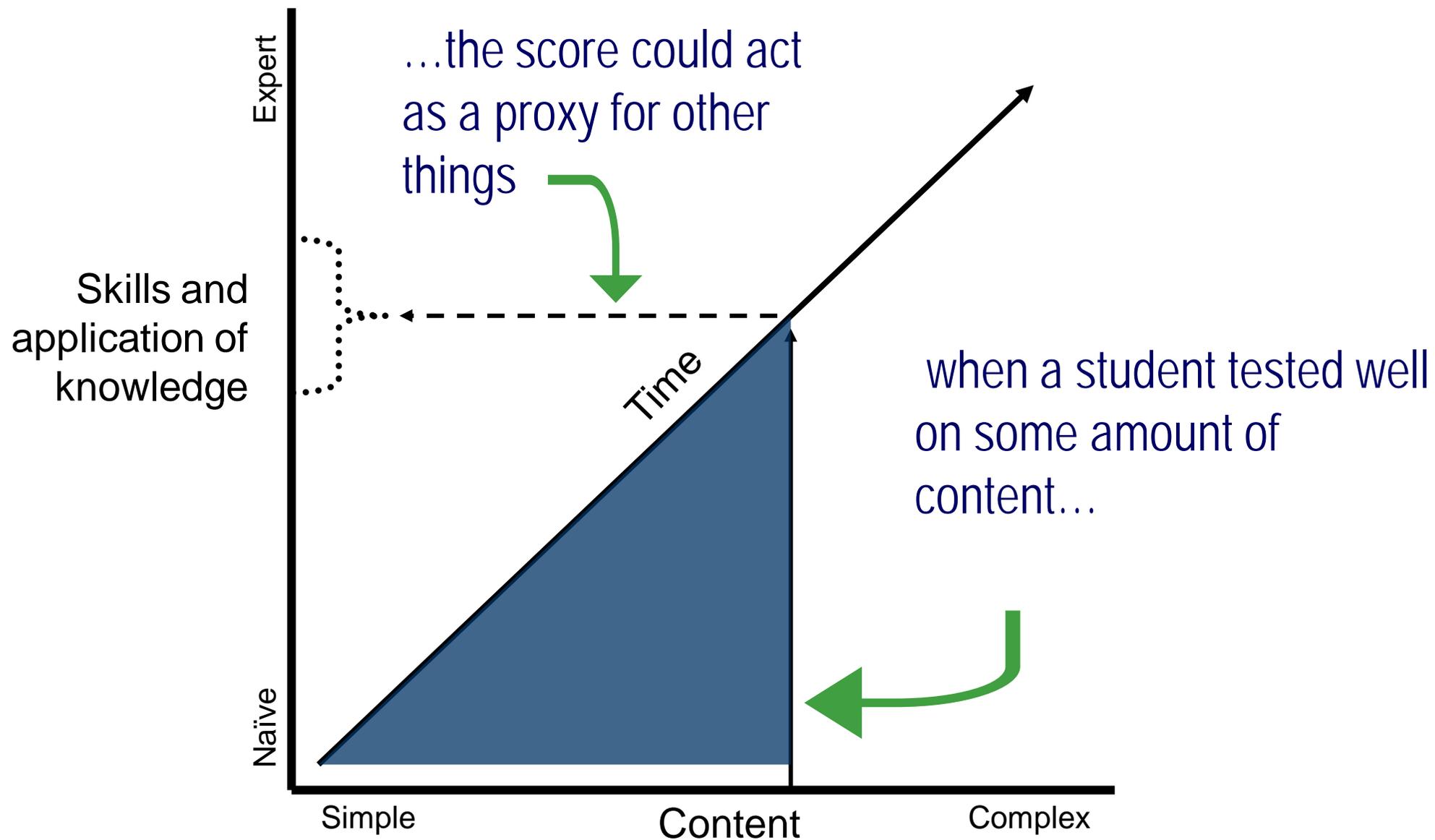
They point to the need to “crack the walls of privatism” in our schools if we are going to create good schools.

The most basic model:

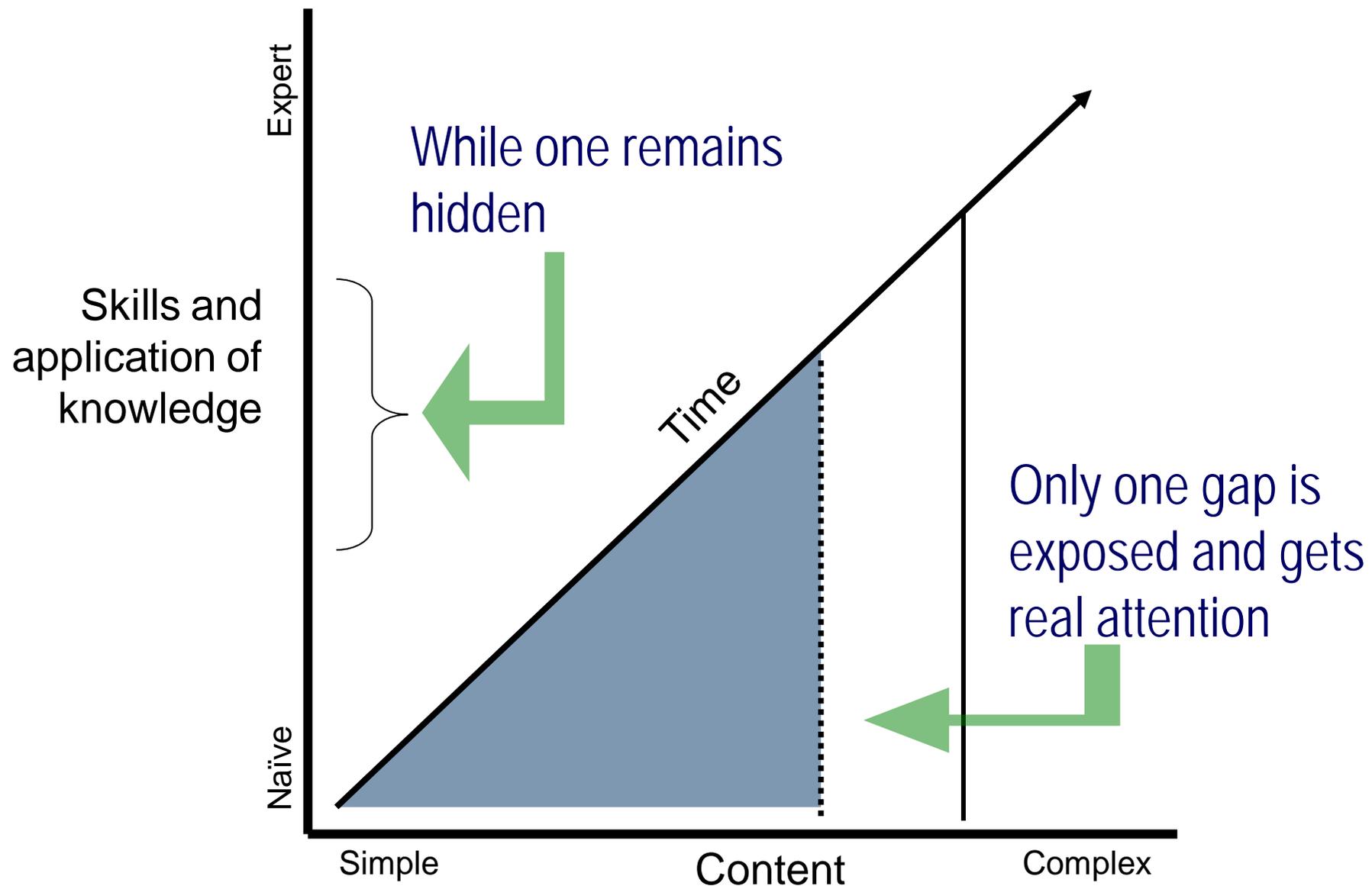


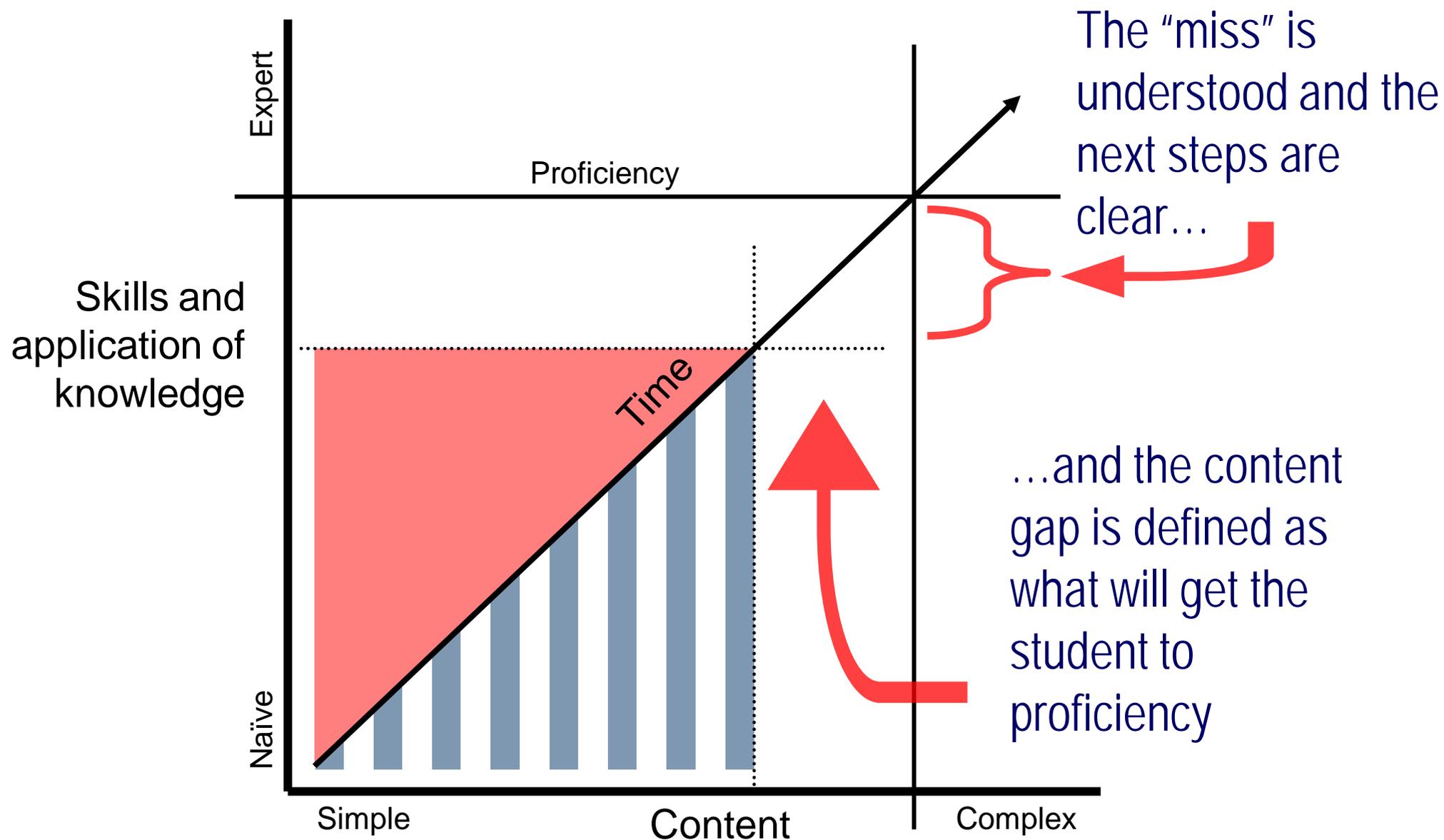
We focus on the content axis:

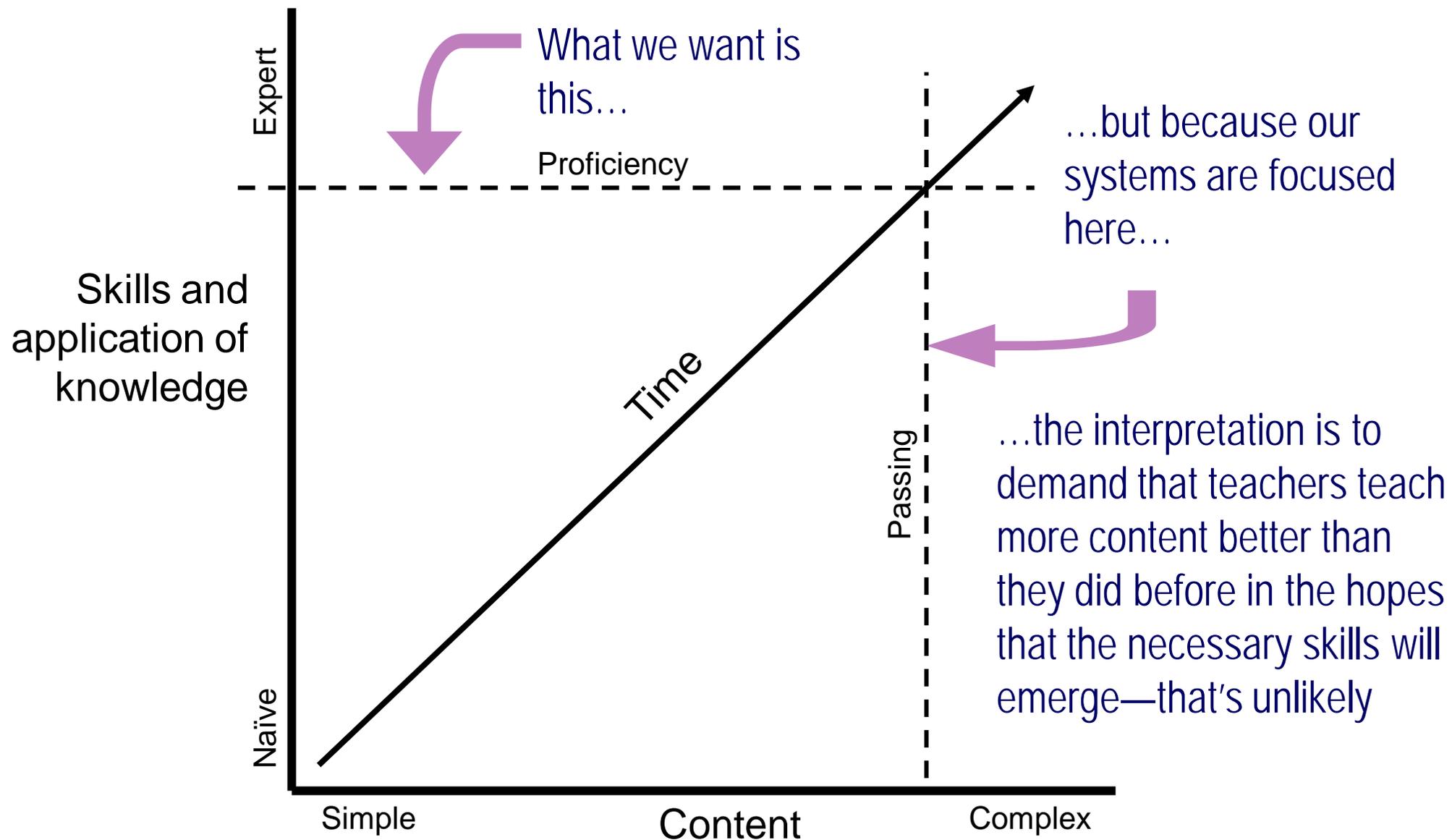




When students fail examinations







Equity in a skills and competency-based system

