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## RESEARCH OUTPUTS / RÉSULTATS DE RECHERCHE

## TEACHING TRIGONOMETRY WITH DYNAMIC GEOMETRY AT GRADE 10

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## Trigonometry in education

Belgian curriculum


Right-angled triangles Positive angles
Degrees
Trigonometric numbers


Any triangle
Positive angles
Trigonometric numbers


Any angle
Unit circle
Radians
Trigonometric functions


Trigonometric functions (derivatives, integrals, graphical manipulations)

## Student's difficulties and

## In litterature [2][4][6][7]

- The length of an arc depends on both the angle and the radius.
- Angle of $0^{\circ}$ and $90^{\circ}$ are not easy to work with in triangles.
- Degrees and radians are proportional. Degrees are beautiful numbers, radians are irrationals, ugly numbers. Why changing ?
- In the unit circle, cosine are abscissa but moving in the cosine function, cosine become ordinates.
- $\pi, \frac{\pi}{4}, \frac{\pi}{6}, \ldots$ are writings, not real numbers.
- Angle measurement depends on the length of its sides.


## Our teacher survey

- The $\pi$ fractions are hard to handle when graduating an axis.
- Angles and trigonometric numbers are hard to distinguish.
- An angle has only one sine, but a sine can be associated to several angles.
- Trigonometric functions are hard to associate to the unit circle.
- Radians are not concrete and $\pi=180$.
- Units are mixed $: \cos (\pi)=-1$ radian.
- Usual algebra rules are misused : $\cos (a+b)=\cos (a)+\cos (b)$.


## Our aims, at Step 2

- Compare the different knowledges from the didactic transposition of Chevallard [3].
- Building a lesson using dynamic geometry to illustrate the Step 2.
- Following the artifact/instrument theory of RABARDEL [5] and the didactic ingeneering process of Artigue [1] to build this lesson.


## Teacher's opinion




## References

[^0]
[^0]:    [1] Artigue, M., Ingénierie didactique, Recherches en didactique des mathématiques 9,3 (1998), 281-308.
    [2] BLoch, I., Activité... la mesure des angles en radians au lycée, Petit × 80 (2009), 47-53
    [3] Chevallard, Y., La transposition didactique, La Pensée Sauvage (1991)
    [4] Proulx, J., L'histoire de la trigonométrie comme outil de réflexion didactique, Bulletin de l'Association Mathématiaue du

