

Collaborative Professional Development Improves High School Teachers' Knowledge

of Invasive Species Ecology

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Incorporating invasive species ecology into curriculum may be challenging for teachers.

Teachers may find it difficult to continue learning about invasive species and incorporate new information into their curriculum. Invasive species ecology may also contain inconsistent or unclear terminology. Some ecologists recommend that teachers **avoid certain terminology** to reduce confusion in invasive species education (Iannone et al., 2020). Thus, we constructed a **collaborative workshop to renovate high school teachers' terminology, curriculum, and understanding of invasive species ecology**. Workshops took place in 2017, 2018, and 2019.

Teachers constructed pre- and post-workshop personal meaning maps (PMM).

We wanted to **assess shifts in teachers' terminology and knowledge** of invasive species through the PMMs. Each PMM consisted of key concepts (**nodes**) and connecting phrases (**links**) (**Figure 1**). We counted the number of nodes and use of scientifically-precise terminology pre- and post-workshop. We grouped the nodes into 37 respective codes, then 10 themes for qualitative and quantitative analysis. We primarily used Wilcoxon signed rank tests in Microsoft Excel.

References

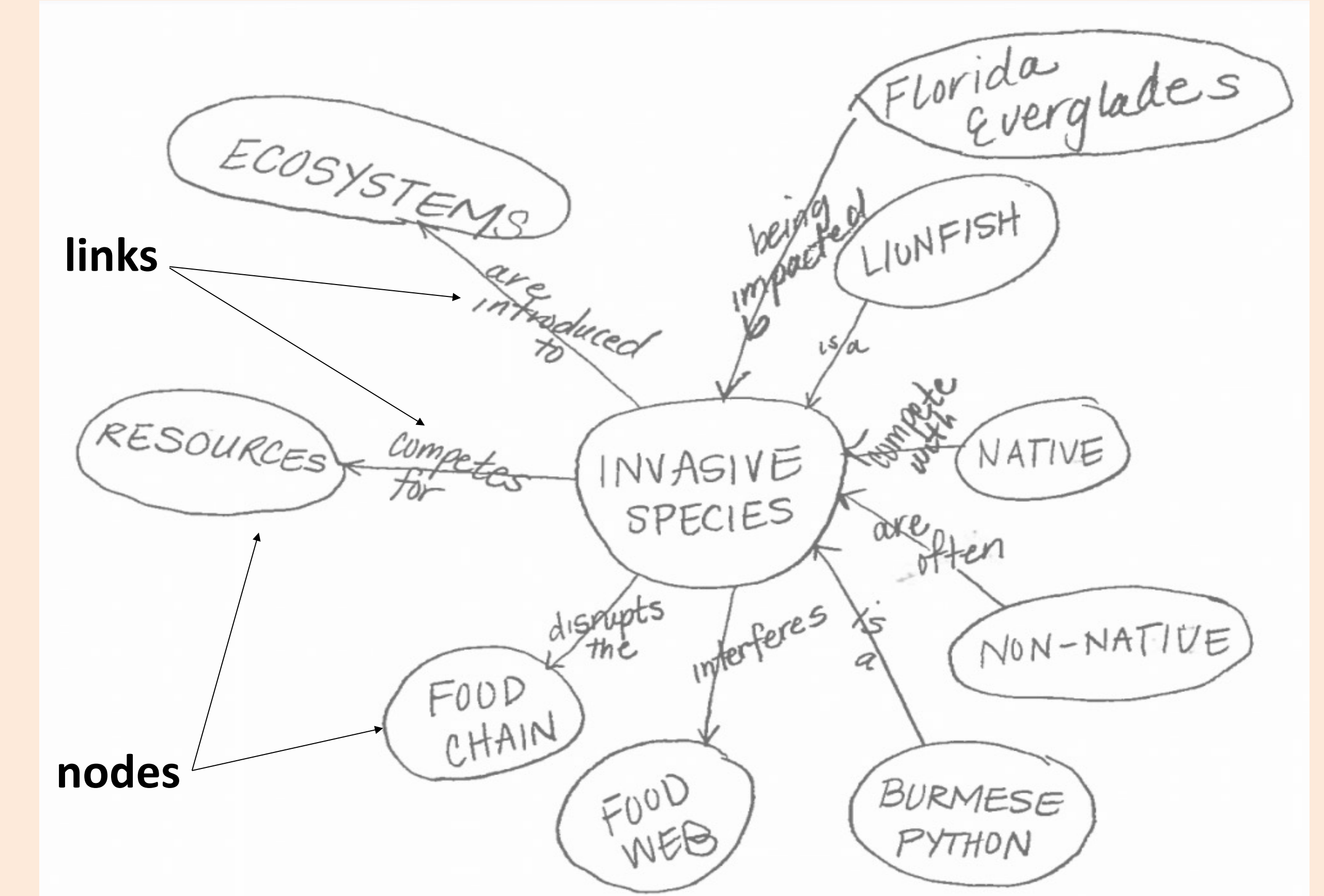
Iannone, B. V., et al. (2020). Invasive Species Terminology: Standardizing for Stakeholder Education. *Journal of Extension*, 58(3).

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Figure 1 Precise and Imprecise Terminology

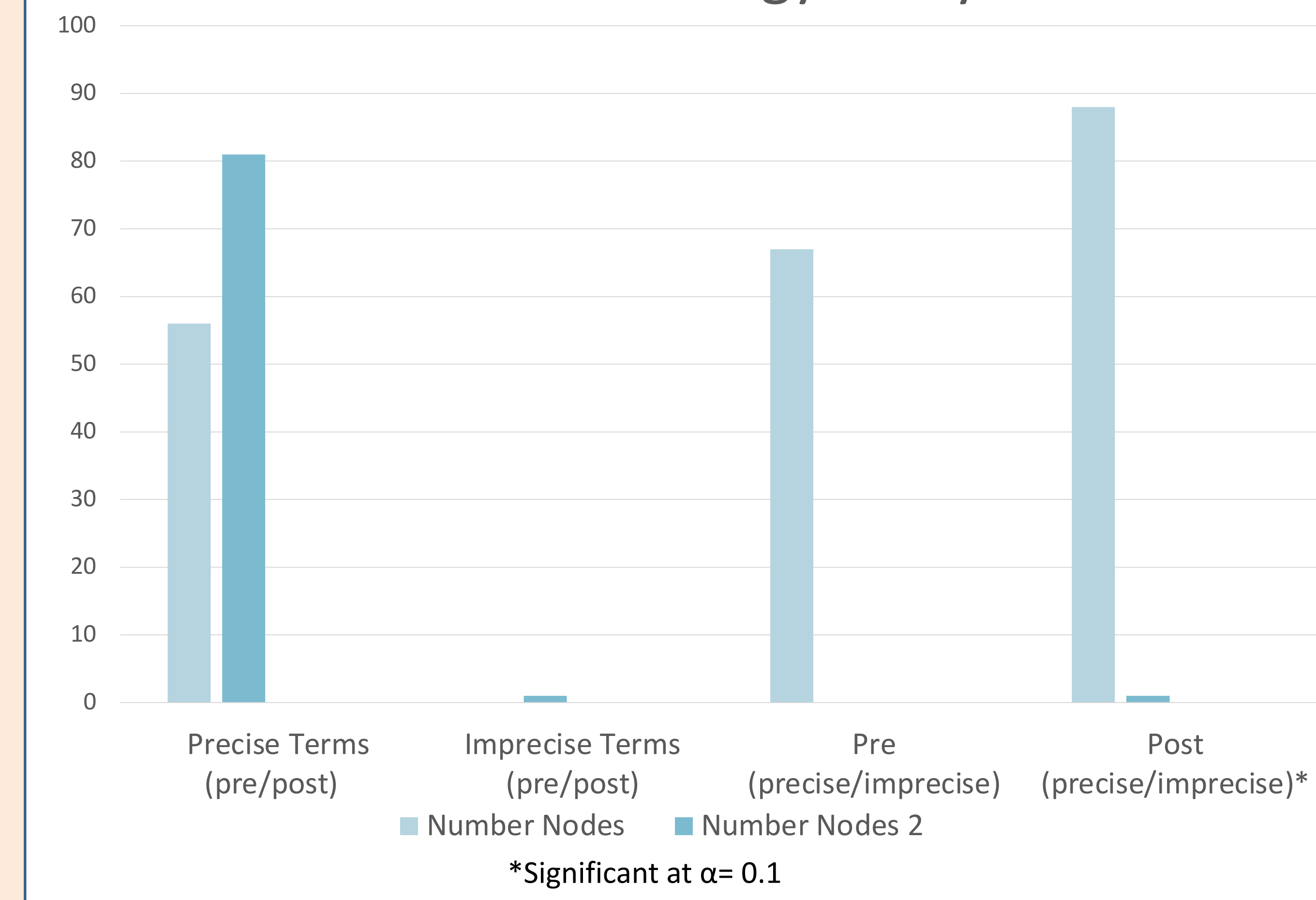
Term	Precise		Imprecise		
	Pre	Post	Term	Pre	Post
native	25	31	foreign	0	0
nonnative	17	31	alien	0	1
introduced	4	1	invasive exotic	0	0
established	0	1	native invasive	0	0
invasive	10	17	invasive weed	0	0
nuisance	0	0	nonindigenous	0	0
range change	0	0	-	0	0

Figure 2 A 2017 Pre-workshop Personal Meaning Map



Results

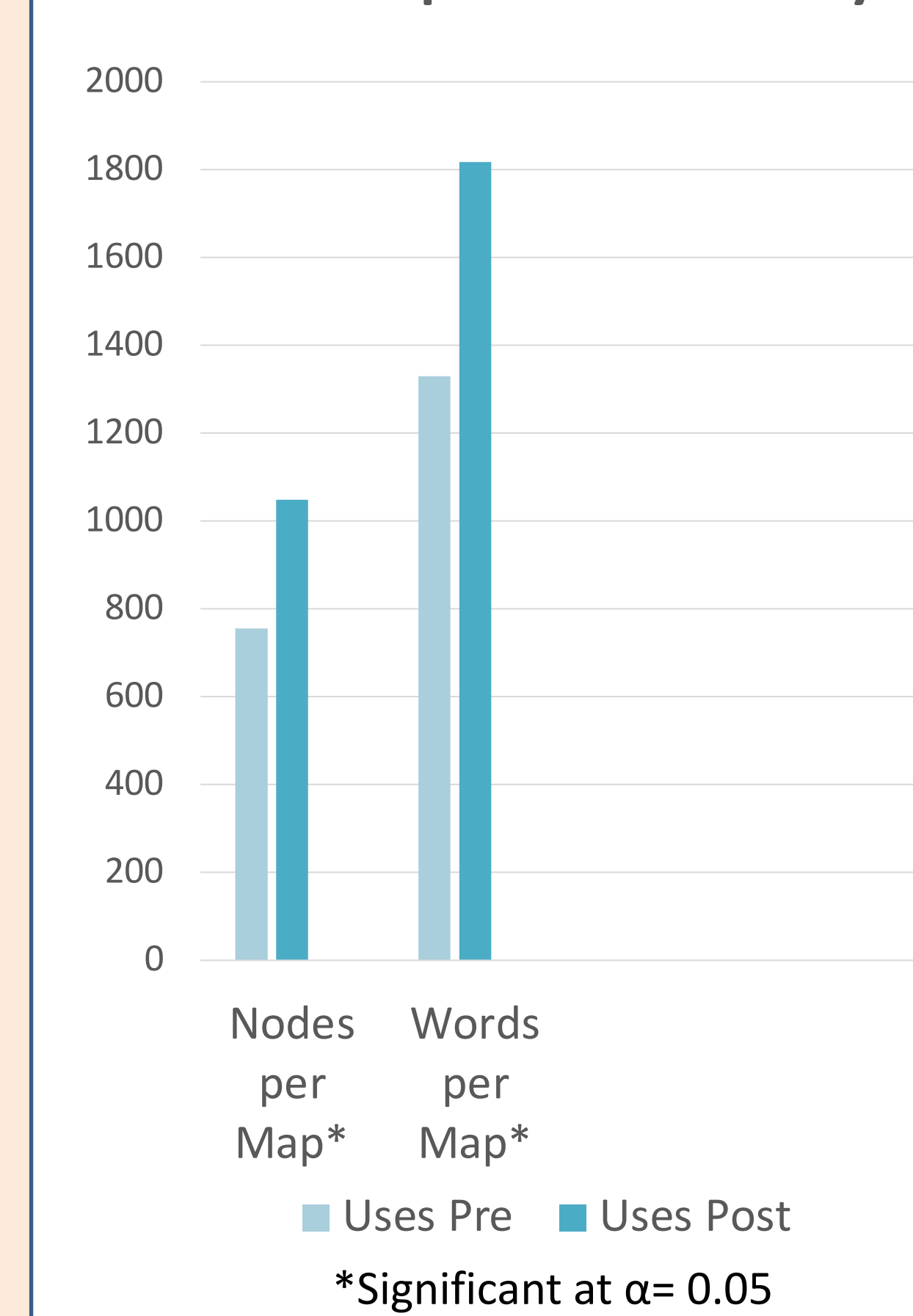
PMM Terminology Analyses



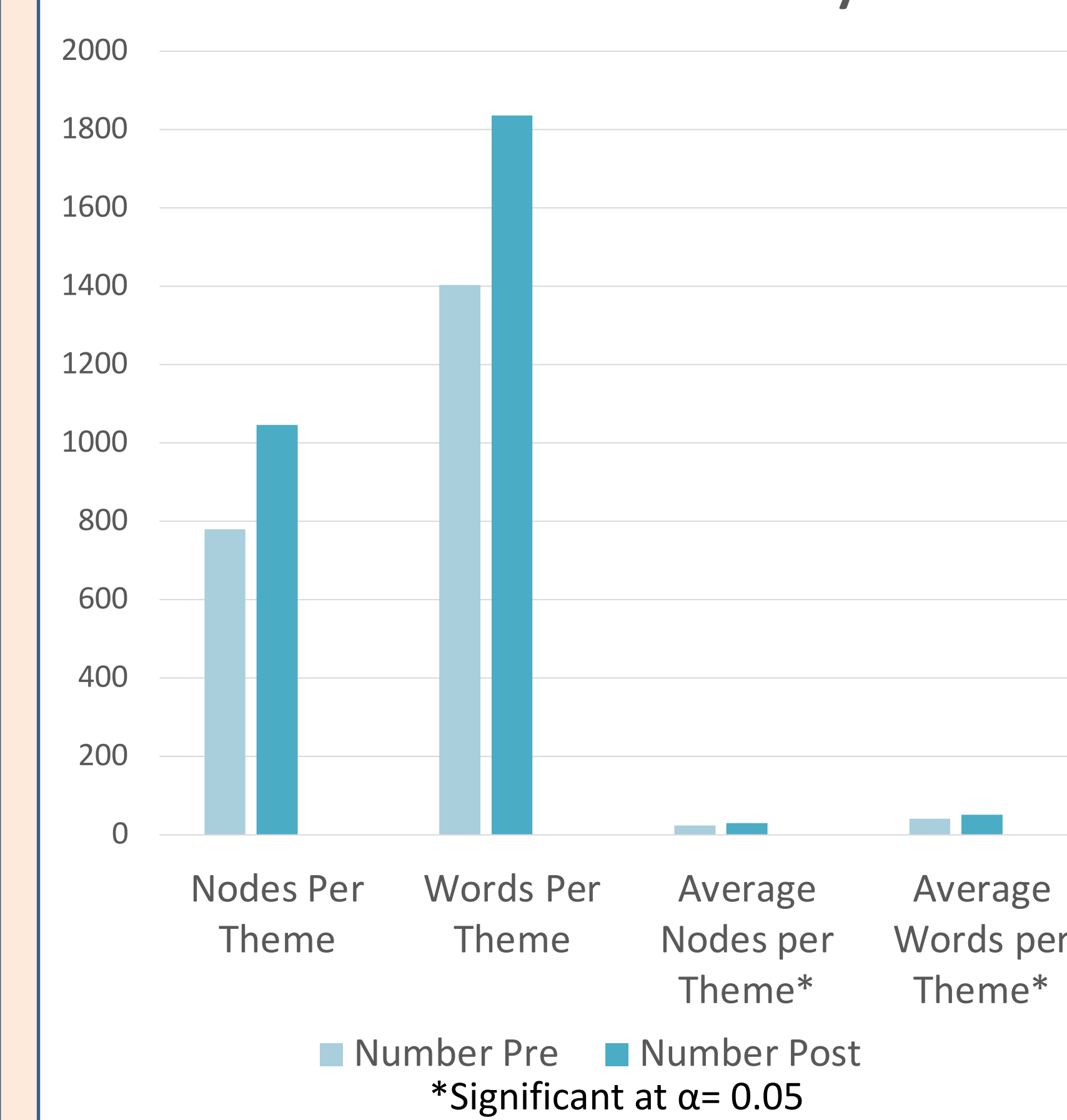
Our qualitative analyses indicate an expansion of knowledge and shift in terminology.

Significantly more precise terms post-workshop, significantly more nodes and words per map post-workshop, significantly more average words and nodes per map, and significantly more average nodes and words per theme **suggest that teachers had expanded knowledge** post-workshop. We did not have enough data to test terminology in terms of precise terms pre vs. post, imprecise terms pre vs. post, or pre-workshop precise vs. imprecise.

PMM Map Size Analyses



PMM Theme Analyses



To further improve invasive species education, we recommend emphasizing terminology in future workshops.

Based on the teachers' node, theme, and terminology data, our workshops seem to be successful. Our next steps include analysis of the specific codes that teachers used within themes to determine the topics that changed the most throughout the workshops (i.e. biology or management). We also recommend that researchers conduct a study on the students' experience and terminology through the invasive species ecology workshops.