The Relationships between General Technology Use, Technology Use at Bedtime, and Sleep

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Introduction

Technology Use

Ninety percent of American adults own a cell phone, 32% an e-reader, and 42% a tablet computer [1]. Technology use throughout the day is prevalent, including in times and places normally used for sleep. In 2011, the National Sleep Foundation found 56% of 13-18 year olds and 42% of 19-29 year olds reported sending, reading or receiving text messages every night or almost every night in the hour before bed [2]. It is possible that common factors of technology use (e.g. light exposure, increased social activity, cognitive, and emotional activation) could be increasing alertness and negatively affecting sleep onset and sleep quality.

Technology Use and Sleep Disruption

Research has indicated watching television, electronic gaming, browsing the internet, and the use of interactive social technology negatively impacts sleep quality and quantity [3]. In adolescents, video game play near bedtime has been linked to negative sleep effects such as later bedtimes, insufficient sleep, increased daytime sleepiness [4-5], as well as increased sleep latency, and decreased sleepiness at bedtime [6].

The Current Study

Based on these findings, a common recommendation to improve sleep is elimination of technology use. It is our aim here is to determine if various forms of technology use (active bedtime use, passive bedtime use, and nonwork related use throughout the day) are related to negative sleep outcomes. Most studies examining the relationship of technology use and sleep research have been conducted with children, adolescents, and college students. Here we examine the question in a group of college students as well as an adult sample from the same academic institution.

Research Question:

Does type of technology use (active bedtime, passive bedtime, or general) influence the relationship between use and sleep in college students or in faculty /staff?

Method

Participants and Procedure

Undergraduate college students (N=383) and faculty/staff members(N=141) at the same institution completed an informed consent, demographic questions, subjective sleep quality, general nonwork-related technology use, and sleep hygiene measures. Upon completion, they were entered into prize drawings.

	College Students	Faculty/Staff	
Age	M=19.57	20-29	11
	SD=1.39	30-39	36
Men	91	Age 40-49	40
Women	200	50-59	34
Other	13	60-69	10
		70+	2
		Sex Men	43
		Women	91
		Other	1

Questionnaires

- *Subjective Sleep Quality:* Participants indicated sleep quality: During the past month, how would you rate your sleep quality overall? (very good, fairly good, fairly bad, very bad).

- *Sleep Hygiene:* The Sleep Hygiene Index (SHI) is a 13-item assessment of the frequency of maladaptive sleep hygiene behaviors (scores from 13-65, high scores reflect maladaptive sleep hygiene) [7] For this study, two additional questions assessing active and passive bedtime social technology use were added.

| *Active Bedtime Technology Use*: I check e-mail, texts, or social media during my sleep time (between going to bed and waking up).	*Passive Bedtime Technology Use*: I sleep with my phone sounds or vibrations turned on where I could hear it if I were awake.	*Nonwork-Related Technology Use*: # of hours per week spent in nonwork related internet, streaming video content, playing electronic games, texting, social networking, video chatting.

- *Nonwork-Related Technology Use:* Participants categorized their weekly nonwork related time spent (none, <1 hour, 1-2 hours, 3-5 hours, 6-9 hours, 10-19 hours, 20-29 hours, 30-39 hours, 40 or more hours) on each of six technology use activities.

- *Associated Features of Poor Sleep Hygiene:* Participants were asked to indicate how frequently (always, frequently, sometimes, rarely, never) they experience associated features of inadequate sleep hygiene (daytime sleepiness, preoccupation with sleep, mood disturbance, decreased motivation, and impaired cognition).

Nonwork-Related technology use is common among both groups.

The technology use score assigned for estimated weekly use indicates a minimum average of 1 ½ to 2 hours of nonwork-related technology use per day. Students reported significantly more weekly nonwork related technology use than faculty/staff (t(423)=3.97; p<.001; d=.39).
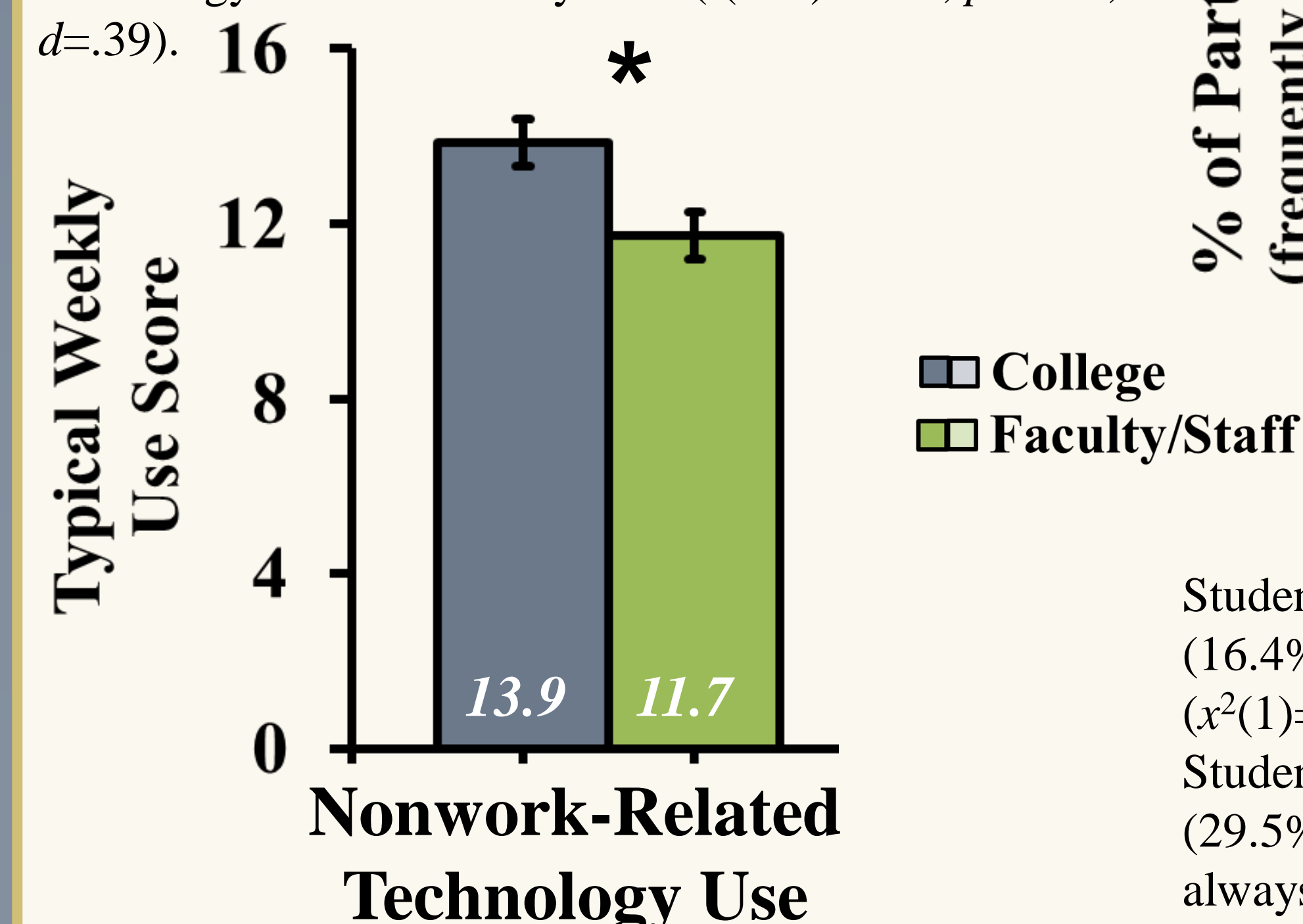
## Frequent Active and Passive bedtime social technology use are common among college students.
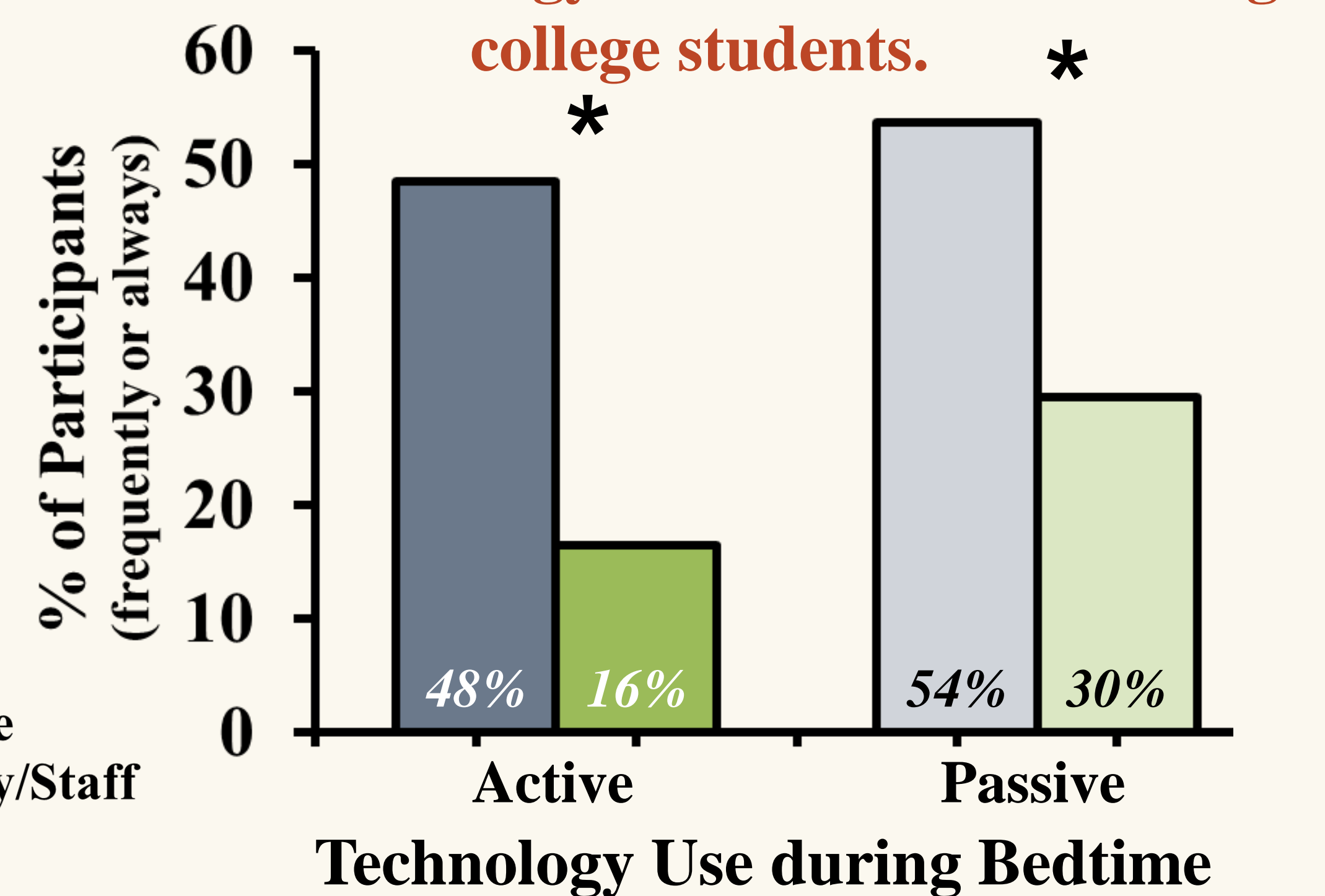
Students were significantly more likely (48.4%) than faculty/staff (16.4%) to use *active* bedtime social technology frequently or always (x^2(1)=38.11; p<.05; Odds Ratio=5.02; 95% CI=2.93 to 8.61). Students were also significantly more likely (53.6%) than faculty/staff (29.5%) to use *passive* bedtime social technology frequently or always (x^2(1)=19.18; p<.05; Odds Ratio=2.76; 95% CI=1.74 to 4.38).

Active bedtime social technology use DID predict disrupted sleep outcome variables for students and faculty/staff.

Replicating previous findings, *active* bedtime social technology use in students significantly predicted worse outcomes on all measured sleep variables: daytime sleepiness (r(247)=.327; p<.001), preoccupation with sleep (r(246)=.246; p<.001), mood disturbance (r(247)=.193; p=.002), avolition (r(248)=.170; p=.007), reduced cognition (r(247)=.166; p=.009), and poorer self-rated sleep quality (r(248)=-.240; p<.001).

Among faculty/staff, *active* bedtime technology use was significantly correlated with sleepiness (r(120)=.263; p=.003) and preoccupation with sleep (r(119)=.176; p=.05).
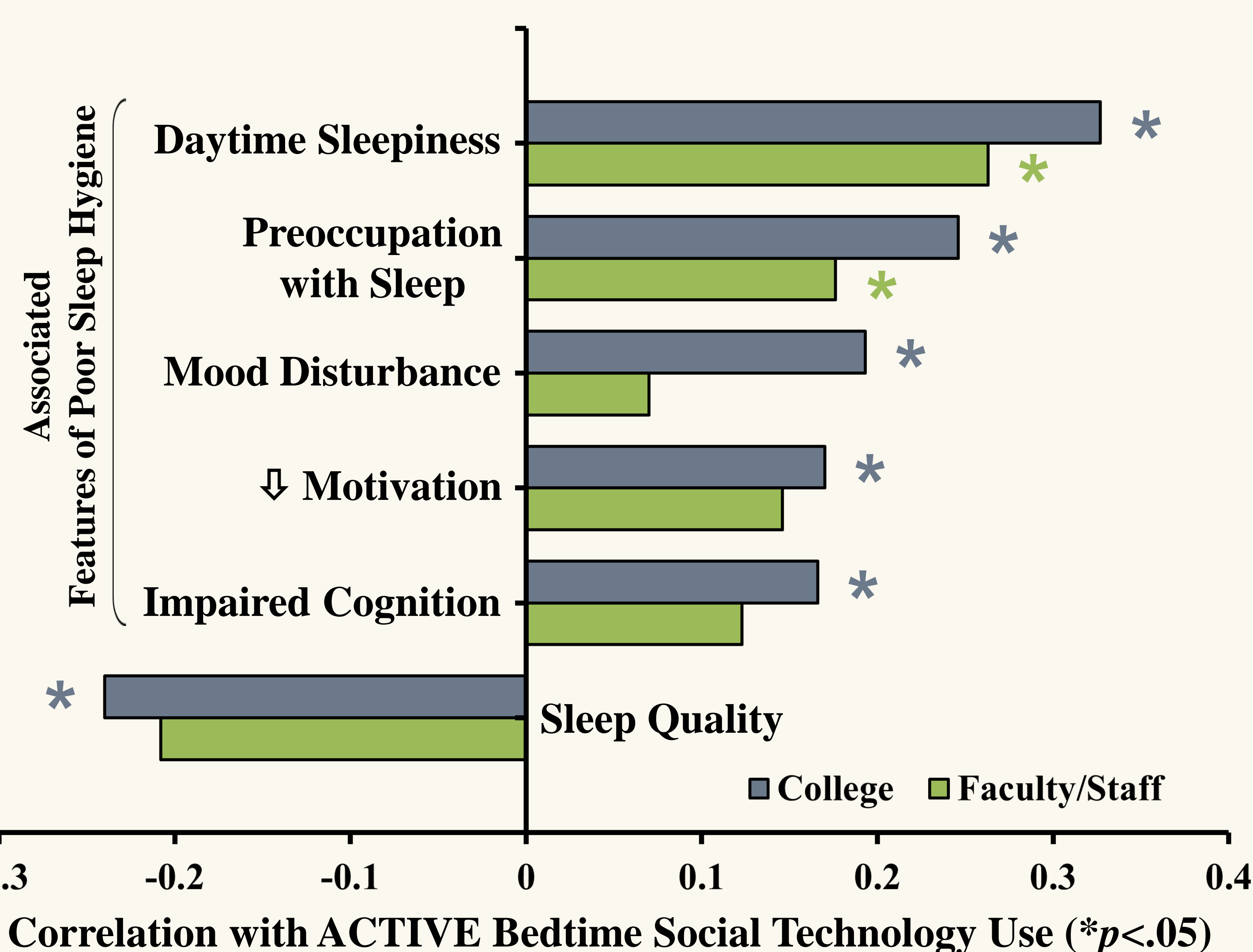
Neither Nonwork-Related use, nor Passive bedtime social technology use, consistently predicted disrupted sleep outcomes for students or faculty/staff.

Sleep Outcomes	Nonwork-Related Use		Passive Bedtime Use	
	College Students	Faculty/ Staff	College Students	Faculty/ Staff
Daytime Sleepiness	r = .084 df = 245	r = -.002 df = 117	r = .111* df = 247	r = .055 df = 120
Preoccupation with Sleep	r = .068 df = 245	r = .050 df = 116	r = .015 df = 246	r = .005 df = 119
Mood Disturbance	r = -.073 df = 248	r = -.036 df = 115	r = -.070 df = 247	r = -.043 df = 118
Decreased Motivation	r = -.016 df = 246	r = .133 df = 116	r = -.067 df = 248	r = -.130 df = 119
Impaired Cognition	r = -.007 df = 245	r = .134 df = 118	r = -.078 df = 247	r = -.027 df = 119
Sleep Quality	r = -.061 df = 248	r = .006 df = 119	r = -.015 df = 248	r = -.116 df = 120

Passive bedtime social technology use in students was marginally significantly correlated with sleepiness (r(247)=.111; p=.08), but no other sleep outcomes. Nonwork-related technology use was not related to disrupted sleep outcomes for students nor for faculty and staff (all p's >.19)

Conclusions

Overall, students and faculty/staff are both frequent users of recreational technology; however, this use was not related to self-reported sleep quality nor outcomes indicating disrupted sleep.

Bedtime technology use (both active and passive) is also common in college students (with about ½ reporting frequent use), on the other hand, it is less common in faculty and staff (only 16% - 30% reporting frequent use). Replicating previous findings, we found, for both college students and faculty/staff, active social technology use at bedtime, was significantly related to self-reported poorer sleep quality and indicators of disrupted sleep. Interestingly, passive technology use was not related to sleep for either group.

Active bedtime technology use and its potential for detrimental impacts on sleep appear stronger in the college population compared to our older faculty/staff group. This difference could be due to a number of reasons: students and adults may use their phones during bedtime for different purposes (e.g. monitoring for frequently occurring socially interesting activity vs. monitoring for infrequently occurring work or family emergencies), technology use may actually be less impactful on adults due to more established sleep habits, or adults particularly impaired by technology use may be more likely to avoid bedtime use leading to primarily those who are more robust to sleep disruption as frequent users.

These findings suggest reduction of active social technology use during designated sleep time as a possible intervention for poor sleep in college students and working adults, but that technology use in general and passive bedtime use may not require curtailment.

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