Students, Social Network Technology and Learning in Higher Education: Visions of

Collaborative Knowledge Construction vs. the Reality of Knowledge Sharing

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November 11, 2020

Abstract

Despite visions of social network technology (SNT) for collaborative knowledge construction, recent research in secondary schools suggest that students use these tools mainly for *knowledge sharing* of study-related artifacts. We extend these findings to higher education settings and report on two survey studies that map characteristics of students' self-directed use of SNTs for study purposes, in undergraduate university programs ($N = 264$) and teacher training colleges ($N = 449$). The combined findings confirm that students use SNTs extensively for uploading, linking and downloading study-related artifacts in peer-directed SNT groups. They regard these practices positively and believe they improve academic achievements. Sharing was predicted by positive attitudes toward sharing and collectivist value orientations, motivated overall by prosocial reasons and less frequent in competitive study programs. Use of shared materials was associated with performance-avoidance achievement goals and lower GPA. Findings, directions for future research and implications are discussed in the context of learning theories, as well the knowledge sharing literature.

Keywords: knowledge sharing; social network technologies; peer collaboration

1. Introduction

The advantages and disadvantages of social network technologies (SNTs) for learning purposes have been debated heavily. Skeptics point out that SNT is mostly used for leisure and social purposes and is negatively related with academic achievement (e.g., Hew, 2011; Junco, 2012; Junco & Cotten, 2012; Kirschner & Karpinski, 2010). Proponents, on the other hand, have emphasized the transformative potential of SNTs and other social media, which are envisioned to propel a change from traditional, authoritative teaching structures toward learning in self-organized, peer-directed, collaborative communities (e.g., Bingham & Conner, 2015; Collins & Halverson, 2009; Greenhow & Robelia, 2009; Harasim, 2000; Wegerif, 2012). Others have criticized the field for simplifying the discussion around impact and for overemphasizing the successes and positive sides of SNT for education, instead of delving deeper into the complexities of the phenomena (e.g., Piotrowski, 2015; Selwyn & Stirling, 2016). In the present work, we aim to contribute to this discussion by reporting on two studies that document characteristics of actual, everyday student-student interactions through SNTs for study purposes.

1.1 Academic Usages of Social Network Technologies

Empirical research on SNTs in and for education has grown exponentially during the last 15 years (Selwyn & Stirling, 2016). Much of the existing research on SNT use in higher education settings has focused on ways in which students harness SNTs for navigating the social aspects of college life (e.g., Amador & Amador, 2014; DeAndrea, Ellison, LaRose, Steinfield, & Fiore, 2012; Wodzicki, Schwämmlein, & Moskaliuk, 2012), rather than on its academic, study-related aspects. Empirical work on SNT for academic purposes, on the other hand, consists predominantly of reports on faculty-led initiatives to incorporate SNTs into formal curricula and course work (e.g., Dabbagh & Kitsantas, 2012; Jones, Blackey, Fitzgibbon, & Chew, 2010;

Kabilan, Ahmad, & Abidin, 2010; Laru, Näykki, & Jarvela, 2012; Molinillo, Anaya-Sánchez,

Aguilar-Illescas, & Vallespín-Arán, 2018). In other words, it explores what *can* be achieved

when SNTs are integrated into instructor-directed, formal course settings and what Moore (1989)

has coined "instructor-learner" interactions. However, a recent study by Smith (2016) shows that

the majority of undergraduate social media interactions for study purposes are either "learner-

content" or "learner-learner" oriented, with little faculty involvement (instructor-learner

interaction). Yet, surprisingly little is known about students', self-directed, learner-learner

oriented SNT interactions for study purposes: Whether, how, why and how often students

themselves choose to interact (or not) through SNTs in their daily study routines,

Recently, scholars from Israel and Denmark have documented the characteristics of such

student-directed, study-related SNT use among secondary school students (Aaen & Dalsgaard,

2016; Asterhan & Bouton, 2017; Bouton & Asterhan, 2017). Findings showed that teenagers use

SNTs not only for social and leisure goals, but also to share with their peers lesson summaries,

whiteboard snapshots, administrative information, homework solutions and advice on a large

scale. Asterhan and Bouton (2017a) concluded that these study-related, SNT-based practices do

not resemble visions of collaborative knowledge construction communities, but are best

characterized as peer-to-peer "knowledge sharing": activities in which individuals share their

own internally stored knowledge or the external knowledge sources they have at their disposal by

making it accessible to others. A follow-up, qualitative study among adult, college students,

showed that their use of SNTs in their daily study routines are comparable to those documented

among secondary school students (Bouton & Asterhan, 2017).

In the present work, we aim to expand this work and explore the extent and

characteristics of student-directed, study-related SNT usage in higher education settings with

larger and more heterogeneous samples and with a quantitative approach. Before turning to the specifics of the current research, we first elaborate on the construct of knowledge sharing.

1.2 Knowledge Sharing in Educational Settings

Knowledge sharing has been a very popular topic of investigation in informational and in organizational sciences, specifically business management (Acquisti & Gross, 2006; Hwang, Vir, Singh, & Argote, 2015; Kankanhalli, Tan, & Wei, 2005). However, it has received surprisingly little scholarly attention in educational studies. Findings from research in organizational settings are expected to be only partially relevant to student knowledge sharing in formal education, because of three main differences:

Firstly, scholars of knowledge sharing in organizational settings use knowledge sharing as a general term for any type of peer work (e.g., Chong, Chong, Chew, & Yuen, 2012). From a learning sciences perspective, however, the distinction between sharing and other types of peer-to-peer learning interactions is pivotal, as they represent different learning processes. For example, Asterhan & Bouton (2017) distinguished between "peer knowledge sharing", "peer cooperation" (coordinating work to create a collective product) and "peer collaboration" (exchanging and building on each other's ideas through shared thinking and discussion) (see also Damon & Phelps, 1989). Even though all three are student-directed, require some form of social interaction and communication between peers, and are conducted within the context of formal learning settings, the quality of interaction and their respective learning benefits cannot be assumed to be identical (e.g., Asterhan & Schwarz, 2016; Dennen, 2013; Hmelo-Silver, Chinn, Chan, & O'Donnell, 2013; Webb, 2009).

Moreover, research in the learning sciences shows that different types of individual learning activities afford different levels of cognitive processing. For example, summarizing key

points from primary sources in one's own words is considered an important activity that not only hones vital academic skills, but also leads to more in-depth and long-lasting understanding of the content (e.g., Chi & Wylie, 2014). Thus, by relying on shared study artifacts and content summaries that were produced by peers, immediate and future learning gains are likely to be forfeited.

Secondly, in organizational settings knowledge sharing is associated with substantive benefits, such as decreased production costs, innovation, revenues and improved team performance (Wang & Noe, 2010). It is therefore heavily encouraged. Attitudes about knowledge sharing in formal education tend to be more ambiguous, however. On the one hand, peer assistance, advice-seeking and help-giving are valued and encouraged. On the other hand, students are evaluated based on individual performance. Sharing of solved solutions, completed homework assignments and answers to test items are considered unethical (cheating) and are therefore prohibited. Even sharing in the sense of exchanging learning derivatives is often discouraged as it is considered to be a more superficial learning strategy.

Lastly, knowledge can be viewed as a public good (Connolly & Thorn, 1990) from which every member of a group may benefit, regardless of whether they personally contribute to its provision (Olson, 1973). In contrast with material public goods, the sharing of knowledge does not result in a material loss on the part of the sharer. Moreover, in a digital setting, its availability does not diminish with use (John, 2013). Yet, interestingly, existing work on knowledge sharing in the workplace documents a general reluctance to share (Bock, Zmud, Kim, & Lee, 2005; Cabrera & Cabrera, 2002). Extensive research efforts have therefore been invested in identifying the environmental and motivational antecedents of knowledge sharing (e.g., Bartol & Srivastava, 2002; Brown, Lawrence, & Robinson, 2005; Davenport & Prusak, 1998; Staples & Webster,

2008). For example, knowledge is 'hoarded' or withheld in competitive settings and when there is political or financial gain from doing so (i.e., knowledge is power). Willingness to share is also affected by interpersonal dynamics (i.e., sense of fairness, trust, expectations of reciprocity) and organizational culture and norms (Webster, Brown, Zweig, Connelly, Brodt, & Sitkin, 2008).

In contrast, recent research on high school students shows that they share learning materials willingly and very frequently, albeit without their teachers' awareness (Asterhan & Bouton, 2017). Sharing intensity was mainly influenced by collectivist value orientations and the reported motivation to share was rooted in pro-social reasons (e.g., helping classmates succeed). Furthermore, sharing among competitively oriented students was also high, but conditioned by expectation of future reciprocity (Asterhan & Bouton, 2017). Thus, the willingness to share and the motivational patterns underlying knowledge sharing for study purposes seemed to differ from those in the workplace.

1.3 The Present Work

The present work is part of a line of research on actual, informal, spontaneous SNT usage by students for study purposes, in which we combine different methodologies (interviews, focus groups, direct observation and surveys) and include different populations (teenagers, student teachers and university students). In this paper, we specifically focus on student-directed, peer-to-peer, SNT-based knowledge sharing for study-related purposes in higher education settings. In a recent explorative, qualitative study, we documented insights into the workings of study-related knowledge sharing in teacher colleges (Bouton & Asterhan, 2017). Sharing was found to be well-organized and central to college students' study routines. However, these findings were based on interviews with a specific subgroup of teacher college students, namely those that self-identified as prominent sharers.

In the current study, we sought to expand these first insights and explore the phenomenon of student knowledge sharing on a larger scale, with a quantitative methodology, and with more heterogeneous samples of higher education students. Survey data were collected from two different students' populations, namely undergraduate university students (Study 1) and teacher college students (Study 2). We aimed to document characteristics of SNT-based knowledge sharing (and sharers), as well as the *use* of shared materials (and users of shared resources). Specifically, we explored the extent of student-directed, study-related knowledge sharing, the type of knowledge artifacts that are shared and used, the motivations behind sharing and student attitudes toward sharing (see Figure 1 for a schematic overview of the different variables targeted).

Insert Figure 1 About Here

Our research questions were as follows:

1. Do higher education students use SNTs for peer-to-peer, study-related knowledge sharing? And if so, to what extent?

2. What are the types of study-related materials that students share with one another and use?

3. What are the main characteristics of prominent sharers and of prominent users of shared materials?

4. What motivates students to share in SNT-based student groups and/or to use shared materials?

2. Study 1

In the first study, we targeted undergraduate students in university settings. Data was collected from students in both highly and less competitive study programs and included measures of students' academic self-efficacy, achievements (GPA), achievement goals, collectivist-individualist value orientations and their motivations for sharing.

2.1 Method

        2.1.1 Participants and procedure. A total of 315 undergraduate students from a large Israeli university were recruited through on- and offline notice boards and campus-based student union social media groups. The notice stated simply that the study focused on "social networks and study". Participation was voluntary, in exchange for academic credits or participation in a pizza coupon lottery, upon choice. Ten students completed the few first survey items and abandoned the study without completing it, resulting in a sample size of 305 (265 online, 40 pen-and-paper). Forty-one students reported not to be a member of any SNT-based, study-related group ($N = 41$) and were excused from further participation. The remaining 264 students reported to be members of online study groups on either Facebook or WhatsApp, with an average number of 104 daily notifications ($SD = 160.46$, range from 1 to 1,000). Mean age of the 264 participants (64 male) was 24.06 ($SD = 2.65$), which is typical for the Israeli, Hebrew-speaking undergraduate population. Even though thirty-four participants failed to report their GPA, self-reported GPA of the remaining 230 participants was 85.35 ($SD = 11.47$). Half of the participants (51%, $N = 135$) were freshmen, 44% ($N = 107$) were second- or third-year undergraduates, whereas 12 participants indicated 'other' (e.g., preparatory programs). Net time to complete the survey was approximately 15 *min*.

        2.1.2 Materials. The complete survey (77 items in all) was similar to the Asterhan & Bouton (2017) study, with adaptions to better fit the terms and practices of university settings, and based on findings from qualitative work that included in-depth interviews (Bouton & Asterhan, 2017) as well as direct observations and analyses of student-student interactions in SNS groups (Rosenberg & Asterhan, 2018). In addition to demographic information (i.e., gender, home town, age, year of degree, study major, mother tongue and GPA), and overall SNT use

(how many notifications daily received, membership in how many SNT-based groups in general) the survey targeted the following variables:

2.1.2.1 *SNT-based, study-related sharing practices.* Participants were asked whether they are members of an SNT study group (and if so, how many), who usually initiates the creation of the study groups ("students", "staff" or "students and staff equally"), the number of group members in a typical SNT study group and the ideal number of members in an effective study group. They were then asked whether they are considered to be prominent sharers in their main group and to indicate the extent they have participated in each of the following study-related knowledge sharing activities: (1) administrative messages (e.g., homework instructions/reminders, exam notifications); (2) snapshots from teacher-created materials (e.g., slides, board, handouts); (3) content summaries (e.g., of class notes, reading materials); (4) solved homework and other individual assignments that have to be handed in; and (5) peer help-giving (e.g., helping friends and explaining points they didn't understand). Frequency of sharing for each type was rated on Likert scale ranging from 1 ("never") to 5 ("very frequently"). They were asked separately about content they have shared themselves ("sharing") and about using shared content posted by others ("use"). Two general scales were obtained by computing the mean score of the four content-related items (all except for administrative messages), resulting in an overall sharing intensity scale ($\alpha = .79$) and an overall use intensity scale ($\alpha = .62$).

2.1.2.2 *Competitive vs. noncompetitive learning environments.* Participants were asked to state their major study program and answers were re-coded into two categories: high and low competitive programs. Major study programs to which admission required a high grade (> 675) on the national university entrance test (Israeli equivalent of SAT, ranging between 200-800) was considered competitive (e.g., medical school, law school, psychology, computer sciences),

whereas majors requiring a lower grade (<675) were considered less competitive (e.g., education, sociology, history, culture studies).

2.1.2.3 *Experiences of sharing*. The survey included five closed statements regarding students' experiences of study-related sharing through online social media. Content of the items was based on findings from previous studies (Asterhan & Bouton, 2017, Bar-Tal & Asterhan, 2017; Bouton & Asterhan 2017; , 2018): Three items tapped into negative experiences and included the following: "I feel as though some people in the group are pressured to share learning materials"," I feel pressured to share learning materials", "I've regretted sharing learning materials". Two items tapped into positive experiences: "I feel as though the learning materials I've shared have helped others", and "I feel I need the learning materials my friends share to succeed". Participants rated their agreement on a 5-point Likert scale ranging from 1 ("not true at all") to 5 ("very true").

2.1.2.4 *Reasons for sharing*. Participants who self-identified as prominent sharers were presented with six distinctive motives for sharing, namely to improve own academic achievements, to help classmates succeed, to achieve positive self-concept, future reciprocity - quid pro quo, to gain social stature, and lack of effort (see Appendix A for the exact phrasing of the items). They indicated their agreement with each on Likert scales ranging from 1 ("not true at all for me") to 5 ("very true for me").

2.1.2.5 *Individualism and collectivism*. Orientation toward collectivist and individualist values was measured by using two of the four scales from the horizontal and vertical individualism and collectivism scale (Singelis, Triandis, Bhawuk, & Gelfand, 1995), which was translated to Hebrew and validated by Adar (2005). Individualist value orientation was measured with a scale originally termed Vertical Individualism. Individual who scores high on this scale

views the self as autonomous and recognizes and accepts the existence of inter-personal inequality. Interpersonal competition is an important aspect of this orientation (Singelis et al., 1995). Examples of items are: "Competition is a law of nature" and "It annoys me when others perform better than I do". Collectivist value orientation was measured by the scale originally termed Horizontal Collectivism. Individuals who score high on this scale see the self as a part of a collective, whose members are perceived as equals. (Singelis et al., 1995). Examples of items are: "The well-being of my co-students is important to me" and "I feel good when I cooperate with others". Participants indicated their agreement on a 5-point Likert scale, ranging from 1 ("not true at all") to 5 ("very true"). Table 1 presents the statistical features of these two and six additional latent variables in the current study.

Insert Table 1 About Here

2.1.2.6 *Academic Self efficacy***.** Efficacy was measured with the New General Self Efficacy Scale (NGSE), which was adapted from Schwarzer and Jerusalem (1995), translated to Hebrew and validated by Chen, Gully, and Eden (2001). Participants indicated their agreement on a 5-point Likert scale, ranging from 1 ("not true at all") to 5 ("very true"). The original eight statements in the NGSE were adjusted to target the academic point of interest in the current study, by adding the word "learning" or "studies" to each statement. Examples are "I can achieve most of the goals I set for myself in my studies" and "Compared to other people, I can do most of the learning tasks well".

2.1.2.7 *Achievement goals***.** Student achievement goals in learning were assessed with 18 items from the Elliot and Church (1997) survey, originally translated to Hebrew and validated by Kogut (2002). These included six mastery goal items (e.g., "I hope that after the course I will have a better and deeper understanding of the topics we learned"), six performance-approach

goal items (e.g., "It is important for me to perform better than the other students in this course")
and six performance-avoidance items (e.g., "I just want to avoid failing the course"). Table 1
shows that the internal reliability indexes of the mastery and of the performance avoidance scales
were inexplicably low. Moreover, the kurtosis of the performance-approach scale was very high
(1.29), and inter-correlation computations furthermore showed that the performance approach
scales correlated positively with the individualistic value orientation scale ($r = .37$, $p < .001$). It is
likely that the two scales tap into the same theoretical construct (see also Asterhan & Bouton,
2017). Because of these reasons, we were forced to omit the achievement goal scales from
further analyses in this study. Table 2 presents the bivariate correlations between the seven
remaining latent variables in the current study.

<p align="center">Insert Table 2 About Here</p>

2.2 Results

The majority (91%) of undergraduate respondents with SNT study group membership
were members of more than one SNT-based study group, reaching four study groups on average
($M = 4.35$, $SD = 3.07$, range 1-25). Nearly all (98%) indicated that the groups are initiated and
created by students, without faculty involvement. Overall scores for *sharing* and for *using shared
materials* were moderately correlated ($r = .45$, $p < .001$). We separately report on findings
regarding (1) students' use of study related knowledge resources shared by others; and (2) the
active act of sharing materials by one's self.

2.2.1 The use of peer-shared study related knowledge artifacts.

2.2.1.1 *What shared artifacts are used?* Half of the respondents (50%) strongly or very
strongly agreed with the statement that they need and rely on SNT-shared resources to succeed
academically ($M = 3.38$, $SD = 1.20$). To ascertain which peer-shared knowledge artifacts

students use most, paired sample *t*-test comparisons were conducted with Bonferroni correction to alpha (.05/10). Participants reported using shared content summaries ($M = 3.81$, $SD = 1.05$) more than any other type of resource, $t(263) > 10.39$, $1.28 \leq d \leq 1.73$, $p < .001$. Students also reported using administrative messages quite often ($M = 3.47$, $SD = 1.19$) and significantly more than solved homework assignments ($M = 2.88$, $SD = 1.29$), snapshots ($M = 2.81$, $SD = 1.37$) and peer assistance ($M = 2.65$, $SD = 1.17$), $t(263) > 6.21$, $0.76 \leq d \leq 1.13$, $p < .001$. No significant differences were found between the latter three, $t(263) < 2.48$. In sum, the following pattern was observed: Content summaries > Administrative Messages = Solved Homework assignments = Snapshots = Peer assistance. Table 3 presents the means and standard deviations of the five learning artifacts commonly used by students.

Insert Tables 3 and 4 About Here

2.2.1.2 *Who uses shared materials?* Table 4 presents the bivariate Pearson correlations between overall use intensity score and the following individual variables: collectivist value orientation, individualist-competitive value orientation, self-efficacy, self-reported GPA and age. Overall use was positively correlated with collectivistic value orientation ($r = .27$, $p < .001$) and negatively correlated with GPA, $r = -.17$, $p = .011$. Age, academic self-efficacy and individualist-competitive value orientation did not correlate with overall use. A between-subject *t*-test showed that female students reported using shared artifacts ($M = 3.19$, $SD = 0.84$) significantly more than male students ($M = 2.91$, $SD = 0.71$), $t(262) = 2.70$, $p = .007$. A Mann-Whitney test showed that female students use content summaries significantly more than males, $U = 7,410$, $(z = 1.98)$, $p = .048$, but no gender differences were found for the other resource types.

A multiple regression analysis was conducted to test if collectivist value orientations, gender and self-reported GPA significantly predict use intensity of shared resources. The three

predictors combined accounted for ten percent of the variance, $R^2 = .10$, Adjusted $R^2 = .09$, F (3, 258) = 9.36, $p < .001$. Collectivist value orientation was the only significant contributor ($\beta = .44$, $p < .001$), while gender was marginally significant ($\beta = .21$, $p = .064$).

2.2.2 The sharing of study-related knowledge artifacts through peer groups. The mean sharing intensity score ($M = 2.21$, $SD = 0.79$) indicates that, on average, the acts of sharing knowledge through SNT groups do not happen very frequently, yet only 26 students (>10%) reported they had never shared any study-related artifacts with their SNT groups. A fifth of the students ($N = 57$, $f = 21.6\%$) indicated that they are considered prominent sharers of knowledge artifacts. This was confirmed by an independent samples t-test: the 57 self-proclaimed prominent sharers shared more ($M = 2.89$, $SD = 0.84$) than other students ($M = 2.00$, $SD = 0.70$), $t(262) = 3.93$, $p < .001$, across all four knowledge artifacts types, $U > 2,211$, $z < -4.04$, $p < .001$.

The analyses on what is shared, reasons for sharing and attitudes about sharing were conducted on this subsample of 57 prominent sharers. Analyses on individual characteristics that predict participation in sharing were conducted on the entire sample.

2.2.2.1 *What is shared?* The most frequent types of shared activities are peer help-giving ($M = 3.46$, $SD = 1.00$) and sharing content summaries ($M = 3.40$, $SD = 1.12$), $t(57) < 1$, which were both more frequent than snapshots teacher made artifacts ($M = 2.35$, $SD = 1.29$) or solved homework assignments ($M = 2.35$, $SD = 1.19$), $t(57) > 5.81$, $1.55 \leq d \leq 1.62$, $p < .001$. No significant differences were found between the latter two, $t(57) < 1$. In sum, the following pattern was observed: Peer help giving = Content summaries > Copying = Snapshots.

2.2.2.2 *Reasons for sharing.* Paired sample t-test comparisons were conducted with Bonferroni adjustments for multiple comparisons (.05/15) on the six different motives for sharing. The most highly rated motive for sharing was to help classmates succeed ($M = 4.21$, SD

= 0.80), $t(55) > 3.42$, $.92 \leq d \leq 2.55$, $p < .001$. The motives that followed were quid pro quo ($M =$ 3.63, $SD = 1.20$), improving positive self-concept ($M = 3.39$, $SD = 1.20$) and lack of effort ($M =$ 3.32, $SD = 1.35$), which were not significantly different from each other, $t(55) < 1.64$, $p > .11$. The least common motives for sharing were to improve one's own academic achievements ($M =$ 2.61, $SD = 1.30$) and own social status ($M = 2.48$, $SD = 1.19$) $t(55) > 3.29$, $.89 \leq d \leq 2.55$, p $< .001$. Thus, the following pattern was observed: helping classmates succeed > quid pro quo = positive self-concept = lack of effort > improve own achievements = gain social status.

Most prominent sharers reported they rarely or never feel regret after sharing (79%, $M =$ 1.61, $SD = 0.86$), never feel peer pressure to share themselves (81%, $M = 1.77$, $SD = 1.09$) and never feel others are pressured (74%, $M = 1.86$, $SD = 1.06$). Most prominent sharers (79%) agreed with the statement that their sharing helps others succeed.

2.2.2.3 *Who shares?* Bivariate Pearson correlations were computed between the sharing intensity score and the following individual variables: collectivist and individualist value orientation, self-efficacy, GPA and age. Table 4 shows that sharing intensity positively correlates only with collectivistic value orientation ($r = .38$, $p < .001$). When tested specifically for sharing of learning resources that are harder to produce (content summaries and peer advice) however, only self-efficacy correlated with sharing ($r = .28$, $p = .036$).

Finally, female students were found to share significantly more ($M = 2.91$, $SD = 0.71$) than male students ($M = 2.00$, $SD = 0.69$), $t(262) = 2.35$, $p = .020$. Separate Mann Whitney tests per sharing types showed that female students shared content summaries more often ($Mdn = 138.93$) than male students ($Mdn = 110.45$), $U = 7,747.0$, $p = .007$.

An independent sample *t*-test showed that students in the more competitive programs (N $= 112$, $M = 2.07$, $SD = 0.72$) share significantly less than students in less competitive ones ($N =$

150, $M = 2.27$, $SD = 0.86$), $t(260) = 2.00$, $p = .046$. Specifically, students in competitive

programs reported sharing significantly less content summaries ($Mdn = 124.54$) than students in

less competitive programs ($Mdn = 135.86$), $U = 7,620.0$, $p = .043$.

A regression analysis was conducted to examine the extent to which gender, collectivist

and individualist value orientation contribute to the prediction of sharing intensity, separately for

the competitive and non-competitive programs, among prominent sharers. In non-competitive

settings ($N=24$), the model was not significant $p = .077$. However, in competitive settings ($N =$

33) the model was significant and accounted for 46% of the overall variance, $R^2 = .51$, adjusted

$R^2 = .46$. $p < .001$. Collectivistic value orientation ($\beta = 1.0$, $p < .001$) was the largest contributor,

followed by individualist value orientation ($\beta = .62$, $p < .001$). Gender did not contribute

significantly ($\beta = .18$, $p = .516$).

2.3 Discussion

The findings show that most undergraduate respondents are members of at least one and

on average four SNT-based study groups. These groups are initiated and created by students,

without faculty involvement. Students use the materials that are shared by peers through SNTs

frequently and many of them strongly feel that they rely on these artifacts to succeed

academically. They most frequently use content summaries and administrative messages. Use of

SNT shared materials was associated with higher collectivist value endorsement, but not with

GPA, gender or any of the other individual features.

On average, students seem to report sharing materials with a much lower frequency than

the frequency of using them. Only a few active sharers are needed in a group for everyone to

profit, however. Indeed, a fifth of undergraduates defined themselves as 'prominent sharers' in

their groups. The type of materials students reported to share most frequently was online peer

assistance. Students also reported sharing and uploading of content summaries, solved homework solutions and snapshots of teacher-distributed learning artifact, frequently and generously.

The prominent sharer is most likely to be female and to endorse collectivist values. This and the self-reported reasons for sharing suggests that the motivations behind sharing are mostly pro-social, to help one's classmates succeed. While not all students use SNTs for learning purposes and keeping in mind a possible predisposition *toward* SNT use that might have favored participation in our survey, the numbers show that SNT-based sharing of knowledge resources is common among university students.

Overall, sharing does not seem to be the result of peer pressure to share, nor does it result in regret after sharing. Yet, when we compared sharing in more and less competitive study programs, different patterns were found: In competitive programs, students shared significantly less overall and prominent sharers endorsed both individualistic and collectivistic values. When they do share, students in these programs do so either because they feel strong connections and responsibility towards their peers, or because it is considered beneficial to them personally (for example by expecting future reciprocation or reputation and expertise pay-offs). These findings align with our own previous finding which showed that among competitively inclined students the motivation to share is mediated by expectations of future benefits (Asterhan & Bouton, 2017), as well as with findings from professional adults in workplace settings (Wang & Noe, 2010).

In less competitive and less prestigious study programs, on the other hand, we did not discern a clear pattern of motivations that drive knowledge sharing. To further explore sharing practices in less competitive programs and in a larger sample of students, the study was replicated in a different higher education setting.

3. Study 2

To explore motivations and characteristics of knowledge sharing in less competitive higher education settings, data was collected from teacher colleges. Previous findings from in-depth interviews with teacher trainees showed that, according to students, interpersonal competition for external incentives is absent, social ties among trainees are overall strong and knowledge sharing is pervasive (Bar-Tal & Asterhan,).

Teacher colleges are particularly interesting as the dilemmas behind sharing (Smith, 2016) is likely to be more salient for teacher trainees, due to their dual identity (as current students, but future teachers), as well as due to the content of studies (theories of learning and teaching). Teacher trainees may be more attuned to the unethical aspects of knowledge sharing (cheating), as well as its potentially negative effects on individual learning outcomes. On the other hand, the lure of sharing and its short-term benefits are tempting for every student, no matter the study program. Smith (2016) has used the 'double-edged sword' simile to capture this dilemma.

Study 2 was also designed to address three shortcomings in Study 1: First, we explore the role of achievement goals in sharing, which were found to major play a role in secondary school settings (Asterhan & Bouton, 2017), but could not be included in Study 1 due to unresolved measurement issues. Second, previous studies have found that personal attitudes toward sharing explain a substantive amount of sharing activities (Bock et al., 2005; Lin, 2007). We therefore added tools to assess student attitudes toward sharing in Study 2. Finally, instead of excluding students who reported not to be members of SNT-based study groups (as in Study 1), the complete survey battery was administered to all participants who are active on SNTs.

3.1 Method

3.1.1 Participants and procedure. A total of 449 students from a large teacher college in a central, urban area in Israel volunteered to participate in this study. The majority of respondents completed a pen-and-paper version of the survey battery, whereas 25% completed an online, digital version. Participants were compensated by lottery tickets to win pizza meal coupons.

The mean age of participants (47 male) was 30.59 ($SD = 7.72$). Over half of the participants ($N = 237$, 53%) were undergraduate students, completing their B.Ed. in various programs combined with a pre-service teacher training program. Almost a third of the participants ($N = 131$, 29%) participated in re-training programs for academics with degrees and work experience in different fields. Forty-seven respondents (16%) were in-service teachers in M.Ed. programs and two (4%) did not state their study program. All had active SNT accounts (e.g., Facebook, WhatsApp). Net time to complete the surveys was estimated at 15-20 *min.*

3.1.2 Materials. The full survey (105 items in all) was similar to the one used in the first study, with slight adaptations to fit the teacher college (instead of university) settings and a few extensions. In the following sections, we only describe the deviations from the Study 1 materials. Table 5 presents descriptive data for the latent variables assessed.

Insert Table 5 About Here

3.1.2.1 *SNT-based study related sharing practices*. In addition to the questions reported in Study 1, participants were asked which platform hosts most of the groups' activities ('WhatsApp', 'Facebook' or 'Google apps'). In addition to the five knowledge artifacts introduced in Study 1, a 6th type was added: lesson plans. As part of their course assignments, student teachers are often asked design and create original lesson plans on their own. Most participants (90%) chose to skip answering the question whether they themselves *use* solved

homework assignments. Given this low response rate, the item was excluded from statistical analyses. Internal reliability indexes for the sharing intensity scale (5 content-related items, excluding administrative messages) and for the use intensity scale (4 content-related items, excluding solved homework assignments and administrative messages) were high, α = .85 for both.

3.1.2.2 *Attitudes toward sharing.* Twelve attitudes (both positive and negative) statements about the phenomena of SNT-based sharing for study purposes were phrased, based on common student responses during in-depth interviews that had been collected in previous stages of the research (Bar-Tal & Asterhan, 2017; Bouton & Asterhan, 2017). Example of items are "Sharing improves the social climate" or "Sharing encourages superficial learning". Participants indicated their agreement with each statement on Likert scales ranging from 1 ('not true for me') to five ('very true for me'). An exploratory factor analysis (with Varimax rotation) was conducted, revealing two distinct factors: a positive attitude (8 items, α =.88) and a negative attitude towards sharing (3 items, α =.67). The full set of 12 items and their loadings on each of the two factors is presented in Table 6.

Insert Table 6 About Here

3.1.2.3 *Reasons for sharing*. The reasons for sharing were identical to the previous study, with the addition of a seventh motive 'peer appreciation' (see Appendix A), following student responses from in-depth interviews and focus groups (Bar-Tal & Asterhan, 2017).

3.2 Results

As in Study 1, the majority of teacher students ($N = 383$, 85%) reported to be members of SNT-based study groups and 74.2% reported simultaneous participation in more than one. The

remaining participants either did not answer the question ($N = 38$) or reported they are not members of any study-related group ($N = 28$).

3.2.1 The use of peer-shared knowledge artifacts.

3.2.1.1 *What shared artifacts do student teachers use?* Table 7 presents the means (and SD) of each resource type used. Of the five types, participants reported using snapshots most frequently ($M = 3.32$, $SD = 1.24$), $t(409) > 2.24$, $.22 \leq d \leq 1.25$, $p < .026$, followed by content summaries ($M = 3.22$, $SD = 1.26$) peer assistance ($M = 3.13$, $SD = 1.21$) and administrative messages ($M = 3.09$, $SD = 1.29$). The least used type of learning resource was lesson plans ($M = 2.50$, $SD = 1.28$), $t(408) > 7.39$, $.73 \leq d \leq 1.25$, $p < .001$. In short, the following pattern was observed: Snapshot > content summaries = administrative message = peer assistance > lesson plan.

3.2.1.2 *Who uses shared materials?* The mean overall use intensity was rather high ($M = 3.06$, $SD = 1.03$) and only 24 participants ($f = 5\%$) reported they have never used any learning resource shared in the group. Bivariate Pearson correlations were computed between overall use score and the following individual variables: collectivist value orientation, individualist-competitive value orientation, self-efficacy, mastery goal, performance approach, performance avoidance, positive attitudes toward sharing, negative attitudes toward sharing, GPA and age (see Table 8). Table 8 shows that use intensity correlated with positive attitudes towards sharing ($r = 0.47$) and collectivist value orientation ($r = 0.32$). Use intensity correlated negatively with GPA ($r = -0.23$) and age. None of the other correlations tested reached significance $p < .07$.

Finally, gender differences in overall use intensity were found, with female students[1] ($N = 402$) reporting more frequent use of shared learning artifacts ($M = 3.13$, $SD = 0.90$), compared

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[1] Possibly due to the majority of female students, the Levene's test was significant. Therefore, equal variance was not assumed.

to male students ($M = 2.57$, $SD = 1.12$), $t(447) = 3.31$, $p = .002$. Specifically, a Mann Whitney test showed that female students use all different types of learning artifacts more, except for administrative messages ($U > 10,049$, $p < .006$).

A multiple linear regression analysis was conducted to examine the extent with which positive feelings towards sharing, collectivist value orientation, avoidance approach, age, gender and GPA predicted use intensity of shared learning resources. The model was statistically significant, $F (6, 400) = 24.35$, $p < .001$, and accounted for more than a quarter of the variance of overall use intensity, $R^2 = .27$, Adjusted $R^2 = .26$. Positive attitudes toward sharing practices ($\beta = .46$, $p < .001$) and gender ($\beta = .45$, $p = .003$) were the largest contributors, followed by collective value orientation ($\beta = .31$, $p < .001$), GPA ($\beta = -.11$, $p = .014$), and age ($\beta = -.09$, $p = .046$). Each added a small, yet statistically significant contribution to the prediction of use intensity. Performance-avoidance did not add to it, however ($\beta = .00$).

3.2.2 The sharing of study-related knowledge artifacts through SNT peer groups.
Mean sharing intensity scores shows that sharing is rather frequent in the full data set ($M = 2.84$, $SD = .98$, $N = 409$). Nevertheless, 19 participants (5 %) reported they have never shared any study-related resource. About a third of participants ($N = 156$) identified as prominent sharers in their study groups. As in Study 1, the analyses on artifacts' type, reasons and attitudes were conducted among prominent sharers only. The analyses on individual characteristics that predict sharing were conducted on the entire data set.

3.2.2.1 *What types of knowledge artifacts are shared?* To examine which types of study related knowledge artifacts are shared more and less often by prominent sharers, paired sample *t*-test comparisons were conducted with Bonferroni alpha correction (.05/15) within each sharing category. Peer help giving ($M = 3.66$, $SD = 1.00$) was the most frequent type of sharing activity

among prominent sharers, significantly higher than any other types of sharing, except snapshots of the board ($M = 3.46$, $SD = 1.15$). Snapshot sharing was also more frequent than content summaries ($M = 3.31$, $SD = 1.26$), administrative messages ($M = 3.30$, $SD = 1.17$), and lesson plan ($M = 3.23$, $SD = 1.23$), $t(154) > 3.05$, $.49 \leq d \leq 1.18$, $p = .003$. In sum, the following pattern was observed: peer help giving = snapshots > summaries = administrative messages = lesson plans. Finally, sharing solved homework assignments was not infrequent ($M = 2.97$, $SD = 1.29$), yet significantly less frequent than any other learning artifacts shared, except lesson plans, $t(154) > 2.99$, $.48 \leq d \leq 1.18$, $p = .003$. Table 7 presents the means and standard deviations of the knowledge resource sharing frequency.

Insert Table 7 About Here

3.2.2.2 *Reasons for sharing.* To examine the seven different explicit reasons behind act of sharing, paired sample *t*-test comparisons were conducted with Bonferroni adjustments for multiple comparisons (.05/21). The most frequently reported motive for sharing, significantly higher than all others, was to help classmates succeed ($M = 4.11$, $SD = 0.92$). $t(155) > 6.68$, $1.07 \leq d \leq 1.80$, $p < .001$. Less common reasons were quid pro quo ($M = 3.44$, $SD = 1.22$), improving academic achievements ($M = 3.42$, $SD = 1.10$), improving self-concept ($M = 3.36$, $SD = 1.28$) and lack of effort ($M = 3.08$, $SD = 1.37$). Under the Bonferroni adjustment ($p < .002$), no significant differences were spotted between these motives $t(155) < 2.65$. Finally, improving social status ($M = 2.85$, $SD = 1.37$) and peer appreciation ($M = 2.78$, $SD = 1.26$) were rated significantly lower than all the other reasons, with no significant difference was found between those two, $t(155) < 1$. In sum, the following pattern emerged: help friends > quid pro quo = improve own performance = improve self-concept = lack of effort > social status = peer appreciation.

Most prominent sharers (60%) reported to have never or seldom felt pressured to share (M = 2.34, SD = 1.35), although about a quarter (23%) did report that they often or very often feel pressured. Half of the prominent sharers (53%) reported that others are never or seldom pressured to share (M = 2.53, SD = 1.31).

3.2.2.3 *Who shares?* Table 8 presents the bivariate Pearson correlations between overall sharing intensity score and the following individual variables: collectivist and individualist-competitive value orientation, self-efficacy, the three achievement goals, positive and negative attitudes toward sharing, GPA and age. Results show that share intensity correlated moderately with positive attitudes (r = .38) and collectivist value orientation (r = .35), and to a lesser extent with mastery goals (r = .18). Sharing intensity correlated negatively with age (r = -.20). Other correlations were not significant.

Insert Table 8 About Here

Finally, female students (N = 399) were found to share more (M = 2.96, SD = 0.98) than male students (N = 47, M = 2.55, SD = 1.06), t(444) = -2.71, p = .007. Mann Whitney tests on the different sharing types showed that female students share more snapshots of teacher created artifacts (U = 11,365, p = .013), content summaries (U = 11,531, p = .007) and lesson plans (U = 11,160, p = .024).

As in Study 1, a stepwise multiple regression analysis was performed with collectivistic value orientation, mastery goals, age and gender entered in Step 1. Together they explained 10% of the overall variance, which is similar to Study 1 results, R^2 = .11, Adjusted R^2 = .10, F (4,420) = 12.57, p < .001. The new variable introduced in Study 2 (positive attitudes toward sharing) was added in step 2 of the model and this nearly doubled the variance explained by the model, R^2 = .20, Adjusted R^2 = .19, F (5, 419) = 21.46, p < .001. Positive attitude toward sharing was the

largest contributor (β = .33, p < .001), followed by collectivist value orientation (β = .15, p = .002) and age, a negative contributor (β = -.13, p = .003). The remaining variables (gender and mastery goals) were not significant (β < .08).

3.3 Discussion

Similar to university undergraduates, most student teachers are members of at least one, and usually several, SNT-based study group. Teacher college students showed positive attitudes toward sharing practices. Similar to Study 1, very few reported they never shared study-related sources, while about a third identified as prominent sharers in their groups.

Using shared materials was found to be very common among teacher college students. The materials used most frequently are snapshots of the board, which in the university sample proved to be one the least used artifacts. At this point, we can only speculate about the reasons behind this difference. College students may take notes to a lesser extent or college faculty may be less inclined to make their PowerPoint slides available to students. Frequent use of study-related resources was also found for the other learning resource types, except for using solved homework assignments, which the majority of college student participants opted not to respond to. The fact that student teachers choose not to respond, instead of replying that they do not participate in such practices, indicates that they likely do use solved homework assignments but, as future teachers, are more aware of the unethical aspects of this practice (cheating) and are therefore less willing to admit their use of it.

Frequent use of peer-shared content materials was predicted by positive attitudes toward sharing, collectivist values, performance-avoidance goal endorsement, age (younger), and GPA scores (lower). These associations may perhaps not be surprising, but are certainly disconcerting. Those students who can benefit the most from effective study practices such as summarizing,

note-taking and homework assignments are, in fact, the ones who are more likely to avoid them and, instead, rely on ready-made, shared artifacts.

The most frequent type of sharing was online peer help-giving, although all other types of learning artifacts were also shared frequently, including solved homework solutions. Student teachers who share materials more frequently are likely to have positive attitudes toward sharing, endorse collectivistic values and be younger. Gender was not found to be a significant contributor, but this is not surprising as most participants in this sample were female students, which is typical of Israeli teacher training colleges. Teacher college students' self-reported reasons for sharing were mainly pro-social, followed by more self-serving reasons, such as reciprocity expectations (quid pro quo) and sharing for improving one's own learning outcomes.

4. General conclusion

The combined findings of the two studies reported here extend findings from secondary school settings (Asterhan & Bouton, 2017) and show that higher education students frequently use SNTs for study purposes and that this usage can best be described as *knowledge sharing*, that is: peer-to-peer sharing of learning materials and resources by uploading, linking and downloading them to designated SNT-based groups that are created, managed and initiated by students themselves. Students share voluntarily and frequently. Sharing and using shared materials has become an integral part of students' study routine. They regard sharing practices positively and believe that it improves their academic achievements.

4.1 Peer learning: Knowledge sharing vs. collaborative knowledge building

The findings presented here could be viewed by a "half cup full" or by a "half cup empty" approach. On the one hand, they could be interpreted in support of claims about the transformative potential of SNT in formal education (e.g., Greenhow & Robelia, 2009; Lambić,

2016): A substantive amount of peer-to-peer interaction in SNT-based student groups seems to revolve around studying and learning. Indeed, students do not only use SNTs for social and leisure purposes that detract from study time and effort. They have also "domesticated" SNTs for study purposes. In addition, they believe it helps them succeed and they are driven by mostly prosocial and collectivist reasons.

On the other hand, however, the majority of SNT-based student practices do not resemble the theoretical ideal of collaborative knowledge building through peer discussion (a/o Asterhan & Babichenko, 2015; Asterhan & Schwarz, 2016; Dennen, 2013; Hmelo-Silver et al.,2013; Webb, 2009). Rather, these are best described as SNT-based knowledge sharing, that is: the up- and downloading of study-related artifacts to peer-directed, SNT-based groups. In both studies, a negative correlation was found between use of shared resources and GPA, suggesting that lower achieving students overly rely on learning artifacts produced by others. Moreover, performance-avoidance achievement goals were positively associated with use of shared materials in the Study 2 sample. Thus, students who aim to avoid revealing their low performance or abilities are more likely to rely on materials provided, created and shared by others.

In conclusion, we posit that even though SNTs *could* in principle be used for peer collaborative learning and in-depth discussions within their study domain, findings from the current set of studies seems to indicate that this is *not* characteristic of current student SNT usage for study purposes. Instead, higher education students most frequently use SNTs for more mundane study-related purposes, namely to obtain processed materials copied, created and shared by others in order to save study time and effort.

Over-reliance on sharing could have negative consequences for actual student learning outcomes. From a learning sciences point of view, students forfeit important learning

opportunities when relying intensively on ready-made summaries, instead of actively processing and extracting the main points from a primary resource by themselves (e.g., Chi & Wiley, 2014). Teacher college student interviews in previous work have shown that students are aware of the potentially less productive sides of knowledge sharing. Among others, they freely admitted that it enables them to skip classes and invest less time for study preparation (Bouton & Asterhan, 2017). We do not claim that all students use shared learning artifacts instead of dealing with the material themselves. Indeed, at least a few students in each data set indicated that they do not use peer shared learning artifacts at all. Yet, as higher education practitioners and/or as educational scholars we should be aware of the pervasiveness of the phenomenon and the lure of using easily accessible and ubiquitously available shared learning artifacts.

Even though we do not have direct empirical evidence showing that increased use of and reliance on digitally stored, peer-shared learning artifacts negatively affects actual learning processes and outcomes, there is strong evidence from adjacent fields that certainly suggests that this is a realistic expectation. For example, the awareness that a particular piece of knowledge is stored and easily accessible on one's digital devices has been shown to have negative effects on actual learning outcomes of that topic (Sparrow, Liu, & Wegner, 2011). Information shared and stored in the online group environment may cause an "illusion of knowledge" (Fisher, Goddu, & Keil, 2015), leading students to overestimate their understanding of materials and invest less study time and effort as a result.

More directly related to the lecture hall, experimental research on the effects of note-taking during lectures have shown the importance of active processing and summarizing main points from an oral presentation in one's own words (e.g., Muller & Oppenheimer, 2014). Research on providing students with teacher-created lecture slides (e.g., Worthington &

Levasseur, 2015) have shown negative effects on learning outcomes, even though students rather univocally believe that it helps them concentrate and study better. Future research should then focus on the consequences of knowledge sharing on student learning outcomes and skill development.

4.2 Knowledge sharing in educational settings

Another aim of the current work was to observe knowledge sharing among students in higher education and compare it with findings from the organizational science literature. Just as in professional settings, where perceived competitiveness is negatively related with willingness to share (e.g., French & Raven, 1959; Staples & Webster, 2008), we found that students in more competitive programs share less. Another similarity pertains to the finding in both studies that positive attitudes towards sharing and collectivist value orientations were strong predictors of sharing tendencies overall (e.g., Bartol & Srivastava, 2002; Brown et al.2005).

One main difference is that students in both higher education (Bart-Tal & Asterhan, 2017 and current study) and in secondary school (Asterhan & Bouton, 2017; Bouton & Asterhan, 2017) shared knowledge willingly, even though they did not perceive any direct gains for this act or social pressure to do so. The motivations behind sharing were mostly prosocial in nature. In the business management literature, many research efforts focus on encouraging knowledge sharing with various incentives (e.g., Bartol & Srivastava, 2002; Quigley, Tesluk, Locke, & Bartol, 2007). It is interesting to note that, similar to work environments, the competitive nature of certain study programs accentuated the conflict of sharing and brought to the fore the different forces driving it: Students shared for pro-social reasons and characteristics, but at the same time, were also motivated by individualistic expectations of future gains.

4.3 Limitations and future directions

The present work was based on student self-reports of peer-to-peer knowledge sharing for study purposes. Using a survey methodology is common in the field of knowledge sharing and is in line with the research aims of the current work (i.e., to describe the scope and general characteristics of the phenomenon). Moreover, the construction of these surveys was informed by findings from in-depth student interviews and direct observations to identify the characteristics and motivations of the phenomenon (Bar-Tal & Asterhan, 2017; Bouton & Asterhan, 2017). In future research, these insights from self-reports should be complemented with direct observations of SNT-based, student-student interactions around study-related topics. However, based on the current findings, as well as previous findings from qualitative studies (Bar-Tal & Asterhan, 2017; Bouton & Asterhan, 2017; Rosenberg & Asterhan, 2018), the overall majority of knowledge sharing practices seems to take place in behind-the-scene, private, informal groups and communication, without the teaching faculty's awareness. For this reason, tracking student knowledge sharing activities in public groups or in course-embedded, teacher-led SNT groups will not suffice. Direct observation and collection of data from private communication channels, on the other hand, poses several significant, albeit not unsurmountable, ethical and practical obstacles that need to be taken into consideration. Future research should also investigate further what students actually *do* with the gathered knowledge resources and what role they play in study behavior (e.g., are they most often used for back-up purposes or do they replace official syllabi reading materials and lectures?).

Another potential shortcoming of the current work is that this study was set in a particular country, Israel, and therefore the types of learning content shared and its scope could be a local phenomenon. However, studies reviewed here suggest that SNTs usage for academic purposes have become as integral part of student experiences in countries around the world (e.g., New

Zealand, Dabner, 2012; Finland, Laru et al., 2011; Germany, Wodzicki et al., 2012; and Malaysia, Kabilan et al., 2010). Considering the ease with which learning materials can be uploaded and shared in these online platforms and the ubiquitous use of SNTs, it is not likely that student-based knowledge sharing in higher education is a local phenomenon, confined to one specific country. Regardless, comparative studies addressing potential cultural differences in norms and practices of student-student knowledge sharing are warranted.

Finally, regardless of whether student knowledge sharing practices are considered as advantageous or detrimental to learning, teaching faculty should be cognizant about its existence and learn about its characteristics. Previous work indicates that the majority of faculty members are largely ignorant about its existence (Bar-Tal & Asterhan, 2017). Considering the ubiquity of the phenomenon, teaching faculty should do well to inform themselves of their students' sharing practices and consider whether and how they should adapt their instructional practices accordingly.

6. References

Aaen, J., & Dalsgaard, C. (2016). Student Facebook groups as a third space: between social life and schoolwork. *Learning, Media and Technology*, *41*, 160–186.

Acquisti, A., & Gross, R. (2006). Imagined communities: awareness, information sharing, and privacy on the Facebook. In G. Danezis and P. Golle (Eds), *Privacy enhancing technologies*. Cambridge, UK: Springer.

Adar, N. (2005). Intercultural diversity in a conflict: examining the intercultural diversity model among kibbutz and city dwellers in Israel. Unpublished doctoral dissertation. Bar-Ilan University, Ramat Gan, Israel.

Amador, P., & Amador, J. (2014). Academic advising via Facebook: examining student help seeking. *Internet and Higher Education*, *21*, 9–16.

Asterhan, C. S. C. & Babichenko, M. (2015). The social dimension of learning through argumentation: Effects of human presence and discourse style. *Journal of Educational Psychology, 107*(3), 740-755.

Asterhan, C. S. C. & Rosenberg, H. (2015). The promise, reality and dilemmas of secondary school teacher-student interactions in Facebook: The teacher perspective. *Computers & Education, 85*, 134–148.

Asterhan, C. S. C. & Schwarz, B. B. (2016). Argumentation for learning: Well-trodden paths and unexplored territories. *Educational Psychologist, 51*(2), 164-187.

Asterhan, C. S. C., & Bouton, E. (2017). Teenage peer-to-peer knowledge sharing through social network sites in schools. *Computers & Education, 110,* 16-34.

Asterhan, C. S. C., & Bouton, E. (2017). Teenage peer-to-peer knowledge sharing through social network sites in schools. *Computers & Education, 110*, 16-34.

Bar-Tal, S., & Asterhan, C. S. C. (2017). Going behind the scenes at teacher colleges: Online student knowledge sharing through social network technologies. *Interdisciplinary Journal of e-Skills and Lifelong Learning, 13*, 167-184

Bartol, K. M., & Srivastava, A. (2002). Encouraging knowledge sharing: the role of organizational reward systems. *Journal of Leadership & Organizational Studies*, *9*, 64–76.

Bingham, T., & Conner, M. (2015). *The New Social Learning. Connect, Collaborate, Work.* Alexandria, VA: ATD.

Bock, G.W., Zmud, R.W., Kim, Y.G. and Lee, J.N (2005) Behavioral intention formation in

  knowledge sharing: examining the roles of extrinsic motivators, social-psychological

  forces, and organizational climate. *MIS Quarterly, Information Technologies and*

  Knowledge Management, *29*, 87-111.

Bouton, E. & Asterhan, C. S. C. (2017). Teenage sharing of learning materials through social

  network sites (in Hebrew). In B. B. Schwarz, H. Rosenberg, & C. S. C. Asterhan (Eds.),

  Breaking down barriers in education? Teachers, students and social network sites (pp.

  53-76).

Brown, G., Lawrence, T. B., & Robinson, S. L. (2005). Territoriality in organizations. *The*

  Academy of Management Review, *30*, 577–594.

Cabrera, A., & Cabrera, E. F. (2002). Knowledge-sharing dilemmas. *Organization Studies*, *23*,

  687–710.

Chen, G., Gully, S.M., & Eden, D. (2001). Validation of a new general self-efficacy scale.

  Organizational Research Methods, *4*, 62-83.

Chi, M. T. H., & Wylie, R. (2014). The ICAP Framework: Linking cognitive engagement to

  active learning outcomes. *Educational Psychologist*, *49*, 219–243.

Chong, C., Chong, S. C., Geok Chew, G., & Yuen, Y. (2012). Knowledge sharing patterns of

  undergraduates students. *Library Reviwe*, *61*, 327-345.

Collins, A., & Halverson, R. (2009). *Rethinking Education in the Age of Technology*: *The Digital*

  Revolution and Schooling in America. New York, NY: Teachers College.

Connolly, T., & Thorn, B. K. (1990), Discretionary databases: Theory, data, and implications. In

  J. Fulk & C.W. Steinfield (Eds*), Organizations and Communication Technology* (219-

  233). Newbury Park, CA: Sage.

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education*, *15*, 3–8.

Dabner, N. (2012). 'Breaking Ground' in the use of social media: a case study of a university earthquake response to inform educational design with Facebook. *The Internet and Higher Education, 15*, 69–78.

Damon, W., & Phelps, E. (1989). Stratecig uses of peer learning in children's education. In T. J. Brendt & G. W. Ladd (Eds), *Wiley Series on Personality Processes. Peer Relationships in Child Development,* (135-157). Oxford, UK: John Wiley & Sons.

Davenport, T. H. & Prusak, L. (1998). Working Knowledge: How Organizations Manage What They Know. Harvard Business School Press, Boston.

DeAndrea, D. C., Ellison, N. B., LaRose, R., Steinfield, C., & Fiore, A. (2012). Serious social media: on the use of social media for improving students' adjustment to college. *The Internet and Higher Education*, *15*, 15–23.

Dennen, V. P. (2013). Activity design and instruction in online learning. In M. G. Moore (Ed.), Handbook of Distance Education (282-298). Routledge.

Elliot A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, *72*, 218–232.

Fisher, M., Goddu, M. K., & Keil, F. C. (2015). General searching for explanations : how the internet inflates estimates of internal knowledge. *Journal of Experimental Psychology*, *144*, 674–687.

French, J. R. P., & Raven, B. H. (1959). *The Basis of Social Power*. Ann Arbor: MI: University of Michigan.

Greenhow, C., & Robelia, B. (2009). Old communication, new literacies: Social network sites as social learning resources. *Journal of Computer-Mediated Communication*, *14*, 1130–1161.

Harasim, L. (2000). Shift happens: Online education as a new paradigm in learning. *The Internet and Higher Education*, *3*, 41–61.

Hew, K. F. (2011). Review: Students' and techers' use of Facebook. *Computers in Human Behavior, 27,* 662-676.

Hmelo-Silver, C. E., Chinn, C. A., Chan, C. K. K., & O'Donnell, A. (2013). *The International Handbook of Collaborative Learning.* London, UK: Routledge.

Hwang, E. H., Vir Singh, P., & Argote, L. (2015). Knowledge sharing in online communities: Learning to cross geographic and hirerchical boundaries. *Organization Science*, *26*, 1553-1804.

John, N. A. (2013). Sharing and Web 2.0: The emergence of a keyword. *New Media and Society*, *15*, 167–182.

Jones, N., Blackey, H., Fitzgibbon, K., & Chew, E. (2010). Get out of MySpace! *Computers & Education, 54*, 776-782.

Junco, R. (2012). Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Computers in Human Behavior*, *28*, 187–198.

Junco, R., & Cotten, S. R. (2012). No A 4 U: The relationship between multitasking and academic performance. *Computers and Education*, *59*, 505–514.

Kabilan, M. K., Ahmad, N., & Abidin, M. J. Z. (2010). Facebook: an online environment for learning of English in institutions of higher education? *The Internet and Higher Education*, *13*, 179-187.

Kankanhalli, A., Tan, B. C. Y., & Wei, K. K. (2005). Contributing knowledge to electronic knowledge repositories: an empirical investigation. *MIS Quarterly*, *29*, 113-143.

Kirschner, P. A., & Karpinski, A. C. (2010). Facebook® and academic performance. *Computers in Human Behavior*, *26*, 1237–1245.

Kogut, E. (2002). Adult attachment styles and the individual's encounter with the achievement domain. Unpublished doctoral dissertation. Bar-Ilan University, Ramat Gan, Israel.

Lambic, D. (2016). Correlation between Facebook use for educational purposes and academic performance o students. *Computers in Human Behavior, 61,* 313-320.

Laru, J., Näykki, P., & Jarvela, S. (2012). Supporting small-group learning using multiple Web 2.0 tools: A case study in the higher education context. *The Internet and Higher Education*, *15*, 29-38.

Lin, H. F. (2007). Knowledge sharing and firm innovation capability: an empirical study. *International Journal of Manpower, 28*, 315-332.

Molinillo, S., Anaya-Sánchez, R., Aguilar-Illescas, R., & Vallespín-Arán, M. (2018). Social media-based collaborative learning: exploring antecedents of attitude. *Internet and Higher Education*, *38*, 18–27.

Moore, M. G. (1989). Three types of interaction. *American Journal of Distance Education, 3,* 1-7.

Muller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: advantages of longhand over laptop note taking. *Psychological Science, 25,* 1159-1168.

Olson, M. (1973). *The Logic of Collective Action: Public Goods and the Theory of Groups.* Cambridge, MA: Harvard University.

Piotrowski, C. (2015). Scholarly research on educational adaptation of social media: Is there evidence of publication bias? *College Student Journal*, *49*, 447–451.

Quigley, N. R., Tesluk, P. E., Locke, E. A., & Bartol, K. M. (2007). A mutlilevel investigation of the motivational mechanisms underlying knoweldge sharing and performance. *Organization Science*, *18*, 1-164.

Rosenberg, H., & Asterhan, C. S. C. (2018). WhatsApp, teacher? Secondary school teachers and students on WhatsApp. *Journal of Information Technology Education: Research, 17,* 205-216.

Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. In J. Weinman, S. Wright, & M. Johnston (Eds), *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35-37). Windsor, UK: NFER-NELSON.

Selwyn, N., & Stirling, E. (2016). Social media and education … now the dust has settled. *Learning, Media and Technology*, *41*, 1–5.

Singelis, T. M., Triandis, H. C., Bhawuk, D. P. S., & Gelfand, M. J. (1995). Horizontal and vertical individualism and collectivism: A theoretical and methodological refinement. *Cross-Cultural Research*, *29*, 240–275.

Smith, E. (2016). A real double edged sword: undergraduates perceptions of social media in their learning. *Computers & Edcuation, 103,* 44-58.

Sparrow, B., Liu, J., & Wegner, D. M. (2011). Google effects on memory: Cognitive consequences of having information at our fingertips. *Science*, *333*, 776-778.

Staples, D. S., & Webster, J. (2008). Exploring the effects of trust, task interdependence and

      virtualness on knowledge sharing in teams. *Information Systems Journal*, *18*), 617–640.

Wang, S., & Noe, R.A. (2010) Knowledge sharing: A review and directions for future research.

      Human Resource Management Review, 20, 115-131.

Webb, N. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British*

      Journal of Educational Psychology, *79*, 1-28.

Webster, J., Brown, G., Zweig, D., Connelly, C., Brodt, S., & Sitkin, S. (2008). Beyond

      knowledge sharing: knowledge hiding and hoarding at work. *Research in Personnel and*

      Human Resources Management, *27*, 1-37.

Wegerif, R. (2012). *Dialogic: Education for the Internet Age*. New York, NY: Routledge.

Wodzicki, K., Schwämmlein, E., & Moskaliuk, J. (2012). "Actually, I wanted to learn": study-

      related knowledge exchange on social networking sites. *The Internet and Higher*

      Education, *15*, 9–14.

Worthington, D. L., & Levasseur, D. G. (2015). To provide or not to provide course PowerPoint

      slides? The impact of instructor-provided slides upon student attendence and

      performance. *Computers & Education*, *85*, 14-22.

Appendix A

Items included in the survey Reasons for sharing

I share learning resources…

1. … because it helps me study better
2. … because I want to help my friends to succeed
3. … because it makes me feel good about myself
4. … so that my friends will return the favor should I need their help in the future
5. … because it strengthens and broadens my network of friends and acquaintances on campus
6. … because it is easy to do so and does not require much effort
7. … because it makes people appreciate me more [a]

[a] This item was added to the survey in Study 2 only

Figure 1

General overview of the variables included in the present work

Demographic characteristics	Motivational characteristics	Study program type
• Academic achievement • Gender • Age	• Achievement goals • Collectivist values • Academic self-efficacy • Sharing attitudes[a]	• (non-) competitive • University undergraduate, teacher college

Peer-to-peer SNT-based knowledge sharing
- Intensity
- Content
- Reasons
- Experiences

Sharing materials	Use of shared materials

[a] Only included in Study 2

Table 1

Descriptive statistics of the eight latent variables measured in Study 1

	No. items	*M (SD)*	Cronbach's α
Overall use of shared materials	4	3.04 (0.84)	.62
Overall share intensity	4	2.19 (0.82)	.79
Individualist value orientation	8	2.75 (0.04)	.77
Collectivist value orientation	8	3.64 (0.03)	.69
Self-efficacy	8	3.77 (0.04)	.93
Mastery goal	6	3.32 (0.04)	.24
Performance-approach goal	6	3.37 (0.04)	.66
Performance-avoidance goal	6	3.23 (0.06)	.53

Note. Likert scales from 1 to 5

Table 2

Bivariate correlations of eight personal characteristics measures in Study 1 (N = 260)

	1	2	3	4	5	6	7
1. Age							
2. Self-reported GPA	**.20****						
3. Self-Efficacy	**.18****	**.35****					
4. Collectivist orientation	.02	.11	.13*				
5. Individualist orientation	-.01	-.03	.11	-.08			
6. Mastery approach goal	.03	.01	**.16****	**.13****	-.01		
7. Performance approach goal	-.02	-.11	-.01	.-05	**.37****	-.05	
8. Performance avoidance goal	.03	-.06	-.03	.09	.03	-.07	.05

* *p* < .05 (2-tailed), **p < .01 (2-tailed).

Table 3

Means (and SD) of the five types of learning materials used and shared in the groups.

	Use (*N* = 264)	Share (*N* = 57)
Administrative messages	3.47 (1.19)	2.93 (1.05)
Snapshots	2.81 (1.37)	2.35 (1.29)
Content summaries	3.81 (1.05)	3.40 (1.12)
Homework solutions	2.88 (1.29)	2.35 (1.19)
Peer help	2.65 (1.17)	3.46 (1.00)

Note. Likert scales from 1 to 5

Table 4

Bivariate Pearson correlations of the six personal characteristic measures with overall use and share intensity in Study 1

	Use (*N* = 264)	Share (*N* = 57)
Age	-.02	-.03
GPA	-.17*	-.15
Self-Efficacy	-.06	.07
Collectivist value orientation	**.27****	**.38****
Individualist value orientation	.09	.12

* $p < .05$ (2-tailed), **$p < .01$ (2-tailed).

Table 5

Descriptive statistics of the ten latent variables measured in Study 2

Variables	No. items	*M (SD)*	Cronbach's α
Use Intensity	4	3.06 (1.03)	.85
Share Intensity	5	2.84 (.98)	.85
Competitive values orientation	8	2.58 (.66)	.75
Cooperative values orientation	7	3.92 (.56)	.72
Self-efficacy	7	4.17 (.59)	.90
Mastery learning goal	6	4.12 (.68)	.87
Performance learning goal	6	2.65 (1.02)	.85
Avoidance learning goal	5	3.09 (.92)	.74
Positive attitudes towards sharing	8	3.70 (.83)	.88
Negative attitudes towards sharing	3	2.37 (.99)	.67

Note. Likert scales from 1 to 5

Table 6

Summary of exploratory factor analysis for positive and negative attitudes towards sharing (Study 2, N = 445)

Item	Descriptives		Factor Loading	
	M	*SD*	Positive attitudes	Negative attitudes
Willingness to share learning materials in SNS among students contributes.	4.20	.85	**.76**	-.25
Sharing exposes students to new things that otherwise they would not have reached	3.98	1.02	**.74**	-.09
Sharing improves understanding of material taught	3.91	1.01	**.83**	-.14
Sharing improves the learning achievements of the students	3.86	1.03	**.84**	-.12
Sharing improves the social climate	3.70	1.10	**.74**	.00
Sharing shortens the time to write assignments	3.47	1.22	**.66**	.26
Sharing shortens the time to learn for tests	3.28	1.32	**.72**	.14
Sharing reduces feelings of loneliness	3.20	1.38	**.67**	.07
Sharing encourages copying of assignments, homework and lesson plans	2.79	1.36	.14	**.74**
Sharing in SNS divides between students who are members of the group and those who are not	2.30	1.25	.14	**.74**
Sharing encourages superficial learning	2.04	1.16	-.06	**.83**

Note. Factor loadings > .4 are in bold

Table 7

Means (and SD) of the five types of learning materials used and shared in the groups

	Use ($N = 449$)	Share ($N = 156$)
Administrative messages	3.11 (1.28)	3.30 (1.17)
Snapshots	3.35 (1.22)	3.46 (1.15)
Content summaries	3.24 (1.25)	3.31 (1.26)
Homework solutions[2]	2.86 (1.32)	2.97 (1.29)
Peer help	3.14 (1.21)	3.66 (1.00)
Lesson plans	2.52 (1.29)	3.23 (1.23)

Note. Likert scales from 1 to 5

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[2] Only 49 participants answered this question.

Table 8

Bivariate correlations of six personal characteristics measures with overall use and share intensity in Study 2 (N ≤ 429)

	1	2	3	4	5	6	7	8	9	10	11
1. Use											
2. Share	**.65****										
3. Age	-.07	**-.20***									
4. Self-reported GPA	**-.23****	-.14	.12								
5. Self-Efficacy	.07	.09	.03	.05							
6. Collectivist value orientation	**.32****	**.35****	**-.24****	-.02	.16*						
7. Individualist value orientation	-.04	-.09	-.05	-.08	.14	-.08					
8. Mastery approach	.15	**.18***	.03	-.00	.46**	.25**	-.04				
9. Performance approach	.03	-.03	-.14	-.05	.14	.06	.71**	.14			
10. Avoidance approach	.05	.11	**-.35****	-.03	-.02	.14	.19*	.17*	.35**		
11. Positive attitudes towards sharing	**.47****	**.38****	-.16	-.19*	.08	**.44****	.00	.11	.08	.14	
12. Negative attitudes towards sharing	.02	-.01	-.09	-.02	-.04	-.16	.36**	-.04	.24**	.16	.11

* *p* < .05 (2-tailed), **p < .01 (2-tailed).