Title: Longitudinal Associations between Narcissism, Mental Toughness and School Achievement

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Abstract: Mental Toughness has been associated with optimal performance across diverse contexts including academic achievement. MT is positively associated with subclinical narcissism. Cross-sectional research reported that high narcissism may contribute indirectly to enhanced positive outcomes, through MT. This study is the first to explore longitudinally the development of the association between MT, narcissism and achievement in a sample of adolescents. MT correlated positively with narcissism and predicted a small percentage of the variation in school achievement. Narcissism did not correlate significantly with school achievement. However, subclinical narcissism exerted a significant positive indirect effect on school achievement through MT. The findings suggest that the relationship between narcissism and MT could be one of the non-cognitive mechanisms that underlie individual variation in school achievement.
Longitudinal Associations between Narcissism, Mental Toughness and School Achievement

Kostas A. Papageorgiou, Margherita Malanchini, Andrew Denovan, Peter J. Clough, Nicholas Shakeshaft, Kerry Schofield and Yulia Kovas

Author Note

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Conflict of interest

All authors declare no conflicts of interest.
Dear Professor Pamela Qualter,

Thank you for your email dated 21st December 2017 and for the helpful comments from the two reviewers. We were glad to read that the manuscript captured the reviewers’ interest. We have carefully addressed the points made by the two reviewers in this cover letter and in the revised manuscript, which we hope you will find sufficient to consider for publication. The changes are presented in this letter and in the “response to reviewers’ document” for each comment separately.

As per your suggestion (and the reviewers’ comments) we have also reduced significantly the length of the supplementary material (from 13 pages, 3,063 words to 6 pages, 1,830 words). This manuscript has 4,984 words.

Sincerely,

Dr Kostas A. Papageorgiou

Reviewer 1

Comment 1: In general, although the topic is interesting and one that I actively pursue, this manuscript is a bit of a jumbled mess. The paper needs to be condensed and re-formatted (as it stands, it is almost like trying to read two separate studies at once). Some of the supplementary material belongs in the text and some of the text can be moved out. For example, the cognitive material is interesting and should be in the text. Table 1 is not required and can be either deleted or moved to supplementary materials. Table "S2" is interesting and should be mentioned in the text (although a sentence with the average correlations would suffice). The procedure section in the supplementary materials section should be in the actual paper (explain how the participants were recruited and tested). I agree that the validation of the new MTQ-10 scale belongs in the supplementary material section. I think Figure 1 would be easier to read if presented as a correlation table (some of the numbers are cut off). A full correlation table of "un-corrected" and corrected (regressing out age and sex) would have been an interesting feature.

Response: We have made a number of changes to address this comment. Specifically, former Table 1 appears in the supplementary material as Table S1. Former tables S2 and S3 appear in the main part of the paper as Tables 2 and 3, respectively (please also see response to comment 7 from Reviewer 2
below). The procedure has moved in the main part of the paper (2.2); the description of the cognitive measures (2.3.4) has moved in the main part of the paper.

Figure 1a and Figure 1b have been replaced by a new Figure (Figure 1, section 3.3) that presents a heat map correlation table of the measures before and after residualizing for age and sex. Please find Figure 1 below:

Figure 1: Heat map presenting correlations between measures before and after residualizing for age and sex

![Heat map correlation table](image)

Note. Narc = Narcissism; MTQ = Mental Toughness; Ach = Achievement; V = Verbal ability; NV = Non-verbal ability; 1 = Wave 1; 2 = Wave 2

**Comment 2:** I do have a curious question about the sample (page 8). If the two waves of testing are four months apart and the same people completed the measures, how did they get younger? The average age drops! They should be 4 months older (?).
Response: We would like to thank the reviewer for noticing this mistake. We have included the correct means in the revised manuscript: “In total 339 students took part in both collection waves (54% females). Participants’ ages ranged between 14 and 21 (M = 15.63, SE = 1.40, in wave 1 and M = 15.83, SE = 1.40 in wave 2).” The means are only two (not four) months apart because the students were reporting their age in years; as such, only part of the sample reported a different age at wave 1 and wave 2 (those that had their birthdays between wave 1 and wave 2).

Comment 3: Section 3.2 - why is sex and age controlled for? Were there sex differences and significant correlations with age? The age range does seem pretty small in this sample. Just using past findings is not reason enough.

Response: We have added the following sentence on supplementary material (section on Descriptive Statistics and Covariates) to address this comment: “In our sample males scored significantly higher than females on MT at wave 1 [F (1, 338) = 35.34, p < .001, η² = .09] and wave 2 [F (1, 338) = 21.44, p < .001, η² = .06]; and on narcissism at wave 1 [F (1, 338) = 18.50, p < .001, η² = .05] and wave 2 [F (1, 338) = 14.36, p < .001, η² = .04]. Age showed a very weak correlation with school achievement at wave 1 (r = .11, p < .05). As such, age and sex were used as covariates in the partial correlation, multiple linear regression and mediation analyses.”

We have also added the following sentence in section 3.2 in the main part of the manuscript: “When all covariates were excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased (β = .16, R² = .026, p < .01).”

Please also see responses to comment 1 above; and response to comment 10 from Reviewer 2 below.

Comment 4: On page 14, I would suggest toning down the statement that the correlations, "grow over time". You only cover a four-month difference and I did not see a test to assess if the strength of the correlations was actually higher in Wave 2 compared to Wave 1.
Response: We have altered this statement to read: “The correlations between measures were significant beyond those observed at wave 1; this finding may suggest that the observed associations grow over time.”

Additional minor comments:

- Page 3 - "It" should be MT?

Response: This has been amended.

- Page 3 - "reflects" should be "reflect"

Response: This has been amended.

- You do not need to report the significance of the correlations of past studies. The magnitude gives a good hint (such as on pages 4 to 6)

Response: The p-values have been removed.

- Page 7 - "extend" and not "extent"

Response: This has been amended.

- Page 13 - should be "provides"

Response: This has been amended.
**Reviewer 2**

**Comment 1:** When reviewing the research on mental toughness I was surprised to see some studies reported that partially showed extremely high correlations with other variables, e.g. with explicit self-esteem where the authors report from a study by St. Clair-Thompson et al. (2016) correlations up to .83 and another study by Gucciardi et al. (2015) where positive relationships between mental toughness and positive emotions with R²= .75 and with thriving R²= .87 have been reported. In my understanding such high correlations strongly provoke the question whether these are not the same constructs but differently labeled. In so far it is not clear whether mental toughness is really a new construct or is not only "old wine in new skins". In any case the introduction should argue why mental toughness is different and has a surplus value as opposed to already existing constructs.

**Response:** The high correlation (r = .83) identified by St Claire et al (2015) might be problematic as discussed by the reviewer. However, this relates to just one aspect of Mental toughness – Confidence- and would be expected. Self-esteem is associated with the other scales – but differentially – demonstrating, we think, it is not simply a ‘new clothes’ phenomenon. We include here the following table that presents the results of St. Clair-Thompson et al. (2015) in detail:


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We have altered the following paragraph is section 1.1 to specify that particularly high correlations were previously reported between self-esteem and confidence; and that MT involves additional (to self-esteem) psychological constructs: “Another study reported that the 4Cs were positively associated with self-esteem \( r = .23 \) for the subscale of control of emotions to \( .83 \) for the subscale of confidence) and college adjustment \( r = .19 \) to \( .70 \); and negatively associated with school concerns \( r = - .27 \) to \(- .52 \) in undergraduate students (St Clair-Thompson et al., 2015). The particularly high correlation between self-esteem and confidence (reported in St Clair-Thomson et al., 2015) is to be expected and it has been acknowledged by a number of authors and approaches (e.g. Cashmore, 2002; Crust, 2008). However, MT represents a number of additional (to self-esteem) psychological constructs including Seeking out challenge; Motivation to achieve; Persistence and Resilience (Clough et al., 2002).”

Comment 2: In the same section (1.2) there is also a repetition of the same results (1st paragraph on page 5 and 3rd paragraph on the same page).

Response: Thank you for noticing this mistake. We have removed the presentation of the results on the first paragraph of page 5.
**Comment 3:** On page 6 the authors argue that "These studies suggest that MT is an important trait in relation to educational transitions with implications for educational practice": Here, it is not clear to me why MT is important for educational transitions because so far the authors have listed evidence that it is important for educational outcomes. One does not necessarily imply the other.

**Response:** This sentence was amended to read: “These studies suggest that MT is an important trait in relation to educational outcomes with implications for educational practice”

**Comment 4:** A core assumption of the authors is that of a relationship between narcissism and mental toughness, but in the introduction they report only very briefly about that assumption by quoting that "… three studies reported significant and positive associations between the two traits." (Onley et al., Sabouri et al., Papageorgiou et al.). This should be reported in more detail, also outlining the size of the relationships found. Moreover, in the same paragraph on page 7 the authors introduce another term that is not explained: self-belief. Here, it is not clear what self-belief is? Is it the same as self-esteem that has been described to correlate highly with mental toughness two pages before?

**Response:** We have included the magnitude of the correlations between MT and narcissism for the three studies. We have also excluded the sentence on self-belief to allow the reader to focus on the essential message of this paragraph (i.e. the relationship between narcissism and MT): “Three studies have explored the relationship between subclinical narcissism and MT in adults (Onley et al., 2013; Sabouri et al., 2015; Papageorgiou, Wong, & Clough, 2017). All three studies reported significant and positive associations between the two traits (r = .13 – .21 between the 4Cs and narcissism; r = .50 for total MT and narcissism; r = .21 for total MT and narcissism, respectively). Furthermore, Papageorgiou et al. (2017) showed that, despite being part of the dark triad, narcissism exerted a significant negative indirect effect on both psychopathy and Machiavellianism through MT. The statistical model suggests that subclinical narcissism could increase MT contributing indirectly to positive outcomes across achievement contexts.”
Comment 5: In section 1.4 maybe the authors better use the term "correlate" instead of "associate" when they describe their hypothesis.

Response: We have amended the hypotheses based on reviewer’s comment:

“Specifically, we hypothesised that:

1. MT will correlate positively with subclinical narcissism in adolescence
2. MT and subclinical narcissism will correlate positively with school achievement
3. MT, narcissism and achievement will associate to each other longitudinally and will show high stability over time.
4. Narcissism will exert a positive indirect effect on school achievement through MT.”

Comment 6: Page 9: When describing the short form of the mental toughness questionnaire by selecting 10 items out of the 48 of the original by Clough et al. (2002) it is not clear on what basis they were selected or how they were selected? Also, the authors should mention here the coefficient alpha and/or the retest reliability of that scale (I am not happy with putting so much (essential) information in the supplementary material; see also my next point).

Response: To address these comments we have added the following text in section 2.3.1 of the revised manuscript: “The 12-item measure derived by taking the two highest line adding items of the MTQ48 in each of the six sub scales. We then performed a Confirmatory Factor Analysis (CFA) on the 12-item measure and resulted in the 10-item version due to poor factor loading for two of the 12 items. The initial CFA on the resultant 12 items from EFA provided unsatisfactory data-model fit on all indices but SRMR, χ² (54, N = 343) = 185.87, p < .001, CFI = .82, IFI = .82, SRMR = .07, RMSEA = .09 (CI of .08 to .11). An inspection of factor loadings revealed that item 7 and item 11 loaded poorly on the general factor (.27 and .22 respectively), and below the recommended threshold of .32 (see Tabachnick & Fidell, 2001). Removal of these items resulted in an improved model fit. The statistical
analysis that was conducted to validate this new measure is described in detail in section the Supplementary Material."

As per the reviewer’s suggestion we have also placed Table 1 (section 3.1) in the main part of the manuscript to present test-retest reliabilities for Mental Toughness, Narcissism, School Grades and School Achievement.

Comment 7: In general and most importantly I was puzzled to find almost a second paper in the supplementary material (the paper is 17 pages, the supplement 13 pages); this is not my understanding of the function of supplementary material; I found it very unusual to include so much written text and even another reference list in the supplement (but finally this is for the editor to decide). There are several aspects, especially the test-retest reliabilities, alphas and so on as well as the information on the intelligence test that must be included in the main part of the paper and not in the supplementary material. In this context, see Page 10, section 3.2: I would suggest to include the information that is given in tables S1 and table S2 within the regular tables of the paper.

Response: We have moved tables S1 and S2 from the supplementary material to the main part of the paper. These tables appear now as tables 1 (Section 3.1) and 2 (Section 3.2), respectively, in the main part of the paper. Please also see response to Reviewer 1 comment 1 above.

We have also reduced significantly the length of the supplementary material (from 13 pages, 3,063 words to 6 pages, 1,830 words).

Comment 8: Associations between mental toughness and school achievement are extremely low in terms of explained variance although they nevertheless reach significance (due to the large sample size, which is good). But it is not clear whether this is due to the fact, that the very short form of the mental toughness assessment employed here (only 10 instead of 48 items in the original version) does not cover all relevant variance of that construct? To assess this, it would really be necessary to have much more detailed information on how the short version was constructed. Either 10 out of 48 items are simply not enough to cover relevant variance of that construct, or alternatively, mental toughness is simply a
construct that does not account for much of school achievement in the age group tested here (as it is reasonably argued in the discussion). It should be outlined more clearly what speaks in favor of which interpretation (and this must be done in the main part of the paper and not the supplement).

**Response:** We have made a number of changes in response to this comment. Please see responses to comments 6 and 7 above.

In addition, we have altered the following paragraph in the discussion to posit the view that the weak association between MT and school achievement may be the product of using the short measure of MT; but most importantly the product of using a measure of school achievement that does not capture the full amount of variation in school grades: “We do think however that MT has an important role to play in school achievement. A possible explanation for the difference between the current findings and previous research is differences in the measures that were used in this study and in previous studies. Specifically, the short measure of MT (MTQ-10) may not capture the full amount of individual variation on MT offering lower explanatory power in relation to performance outcome. More importantly, however, we think that the scale of self-reported school grades is not sensitive enough to capture the full amount of variation that exists in the lower end of the distribution (the scale ranges from 4 to 10 where 4 represents any score from 0 to 4). Future studies could assess longitudinally total MT and the 4Cs and employ additional measures of school achievement in order to test the predictive power of MT on school performance.”

**Comment 9:** Page 13: I cannot follow the argumentation in paragraph 2, namely that “… it suggests that some non-cognitive traits are more relevant to performance in certain aspects of academic attainment”). What does this mean? More relevant compared to what?

**Response:** We meant to suggest that MT might have a more important role to play in certain educational outcomes (e.g. literacy) as compared to others (e.g. mathematics). We have rephrased this sentence to make this clear: “This finding requires further investigation as it suggests that MT may be
more relevant to certain aspects of academic attainment (such as in literacy) as compared to others (such as in mathematics).”

**Comment 10:** It is good that the authors introduced cognitive ability as a control variable; maybe the authors could report on how much the original relations between mental toughness at wave 1 and school achievement at wave 2 were reduced when introducing a cognitive ability as a control variable. I presume that cognitive ability took away much of that variance?

**Response:** Indeed, cognitive ability took away much of the variance on school achievement that was predicted by MT. We have added the following sentence in section 3.2 of this revised manuscript: “When cognitive ability was excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased significantly (β = .19, R² = .032, p < .01).”

**Comment 11:** Page 15: I am not sure what the authors mean by "… suggesting that the joint manifestation of high narcissism and high MT relates to positive outcomes": I haven't looked into the paper of Papageorgiou, the authors refer here to, but I ask myself what this conclusion means? The formulation of a "joint manifestation" could in my view rather be read as an interactive effect where high narcissism and high mental toughness coming together produce a multiplicative effect (not only an additive effect).

**Response:** We have rephrased this sentence to be more accurate: “This is in line with recent findings (see Papageorgiou et al., 2017) suggesting that subclinical narcissism may increase MT, a trait that is relevant across achievement contexts, contributing indirectly to positive outcomes.”

**Comment 12:** Page 16: I can follow the authors' tendency to cut out narcissism from the dark triad; and arguing in favor of a more bright trait, but the statement in the last sentence of the paper sounds to me much too strong, given the many report of negative effects of narcissism reported in the literature. A single paper like this one - that moreover did not really show any important influence of narcissism
with respect to school achievement - cannot serve as a basis of putting away narcissism from the dark traits in personality psychology.

**Response:** We did not aim to suggest that narcissism should be excluded from the dark triad of personality. Instead, we want to suggest that the context, where a personality trait is expressed is important and should be taken under consideration. We have rephrased this last sentence to read: “The current findings do not provide strong evidence for excluding subclinical narcissism from the dark triad of personality traits. However, the notion that scoring high on subclinical narcissism may increase school performance, through MT, supports the idea of studying the contextual adaptive and maladaptive aspects of traits; instead of focusing on rigid dichotomies between prosocial versus socially malevolent personality traits.”

**Additional minor comments:**

- The name Vaselka is misspelled throughout the manuscript, it must be Veselka.

  **Response:** This has been amended.

- p. 6: 'used as sample of twins' should probably read as "used a sample of twins …"

  **Response:** This has been amended.

- p. 8, 1st sentence: "… are described IN Section 1 …"

  **Response:** This has been amended.

- In the references some of the papers are not listed properly (e.g. volume and page numbers missing, like in Dumfart & Neubauer, 2016 and others)

  **Response:** These have been amended.
Re: Ref. No.: PAID-D-17-01885

Dear Reviewers,

We would like to thank you for the comments and feedback. Please find our response below.

Reviewer 1

Comment 1: In general, although the topic is interesting and one that I actively pursue, this manuscript is a bit of a jumbled mess. The paper needs to be condensed and re-formatted (as it stands, it is almost like trying to read two separate studies at once). Some of the supplementary material belongs in the text and some of the text can be moved out. For example, the cognitive material is interesting and should be in the text. Table 1 is not required and can be either deleted or moved to supplementary materials. Table "S2" is interesting and should be mentioned in the text (although a sentence with the average correlations would suffice). The procedure section in the supplementary materials section should be in the actual paper (explain how the participants were recruited and tested). I agree that the validation of the new MTQ-10 scale belongs in the supplementary material section. I think Figure 1 would be easier to read if presented as a correlation table (some of the numbers are cut off). A full correlation table of "un-corrected" and corrected (regressing out age and sex) would have been an interesting feature.

Response: We have made a number of changes to address this comment. Specifically, former Table 1 appears in the supplementary material as Table S1. Former tables S2 and S3 appear in the main part of the paper as Tables 2 and 3, respectively (please also see response to comment 7 from Reviewer 2 below). The procedure has moved in the main part of the paper (2.2); the description of the cognitive measures (2.3.4) has moved in the main part of the paper.

Figure 1a and Figure 1b have been replaced by a new Figure (Figure 1, section 3.3) that presents a heat map correlation table of the measures before and after residualizing for age and sex. Please find Figure 1 below:
Comment 2: I do have a curious question about the sample (page 8). If the two waves of testing are four months apart and the same people completed the measures, how did they get younger? The average age drops! They should be 4 months older (?).

Response: We would like to thank the reviewer for noticing this mistake. We have included the correct means in the revised manuscript: “In total 339 students took part in both collection waves (54% females). Participants’ ages ranged between 14 and 21 (M = 15.63, SE = 1.40, in wave 1 and M=15.83, SE=1.40 in wave 2).” The means are only two (not four) months apart because the students were reporting their age in years; as such, only part of the sample reported a different age at wave 1 and wave 2 (those that had their birthdays between wave 1 and wave 2).

Comment 3: Section 3.2 - why is sex and age controlled for? Were there sex differences and significant correlations with age? The age range does seem pretty small in this sample. Just using past findings is not reason enough.
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We have also added the following sentence in section 3.2 in the main part of the manuscript: “When all covariates were excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased \(\beta = .16, R^2 = .026, p < .01\).”

Please also see responses to comment 1 above; and response to comment 10 from Reviewer 2 below.

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**Additional minor comments:**
- Page 3 - "It" should be MT?

**Response:** This has been amended.
- Page 3 - "reflects" should be "reflect"

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- You do not need to report the significance of the correlations of past studies. The magnitude gives a good hint (such as on pages 4 to 6)

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Reviewer 2

Comment 1: When reviewing the research on mental toughness I was surprised to see some studies reported that partially showed extremely high correlations with other variables, e.g. with explicit self-esteem where the authors report from a study by St. Clair-Thompson et al. (2016) correlations up to .83 and another study by Gucciardi et al. (2015) where positive relationships between mental toughness and positive emotions with $R^2 = .75$ and with thriving $R^2 = .87$ have been reported. In my understanding such high correlations strongly provoke the question whether these are not the same constructs but differently labeled. In so far it is not clear whether mental toughness is really a new construct or is not only "old wine in new skins". In any case the introduction should argue why mental toughness is different and has a surplus value as opposed to already existing constructs.

Response: The high correlation ($r = .83$) identified by St Claire et al (2015) might be problematic as discussed by the reviewer. However, this relates to just one aspect of Mental toughness – Confidence- and would be expected. Self-esteem is associated with the other scales – but differentially – demonstrating, we think, it is not simply a ‘new clothes’ phenomenon. We include here the following table that presents the results of St. Clair-Thompson et al. (2015) in detail:


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4. Control of life  .54**  .66**  .32**  -  
5. Control  .56**  .55**  .84**  .78**  -  
6. Confidence in abilities  .66**  .64**  .39**  .74**  .68**  -  
7. Confidence interpersonal  .61**  .36**  .22*  .47**  .42**  .48**  -  
8. Confidence  .74**  .61**  .37**  .73**  .66**  .91**  .81**  -  
10. Self-esteem  .61**  .61**  .23**  .73**  .56**  .79**  .61**  .83**  -

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Comment 2: In the same section (1.2) there is also a repetition of the same results (1st paragraph on page 5 and 3rd paragraph on the same page).

Response: Thank you for noticing this mistake. We have removed the presentation of the results on the first paragraph of page 5.

Comment 3: On page 6 the authors argue that "These studies suggest that MT is an important trait in relation to educational transitions with implications for educational practice": Here, it is not
clear to me why MT is important for educational transitions because so far the authors have listed evidence that it is important for educational outcomes. One does not necessarily imply the other.

Response: This sentence was amended to read: “These studies suggest that MT is an important trait in relation to educational outcomes with implications for educational practice”

Comment 4: A core assumption of the authors is that of a relationship between narcissism and mental toughness, but in the introduction they report only very briefly about that assumption by quoting that “… three studies reported significant and positive associations between the two traits.” (Onley et al., Sabouri et al., Papageorgiou et al.). This should be reported in more detail, also outlining the size of the relationships found. Moreover, in the same paragraph on page 7 the authors introduce another term that is not explained: self-belief. Here, it is not clear what self-belief is? Is it the same as self-esteem that has been described to correlate highly with mental toughness two pages before?

Response: We have included the magnitude of the correlations between MT and narcissism for the three studies. We have also excluded the sentence on self-belief to allow the reader to focus on the essential message of this paragraph (i.e. the relationship between narcissism and MT): “Three studies have explored the relationship between subclinical narcissism and MT in adults (Onley et al., 2013; Sabouri et al., 2015; Papageorgiou, Wong, & Clough, 2017). All three studies reported significant and positive associations between the two traits (r = .13 – .21 between the 4Cs and narcissism; r = .50 for total MT and narcissism; r = .21 for total MT and narcissism, respectively). Furthermore, Papageorgiou et al. (2017) showed that, despite being part of the dark triad, narcissism exerted a significant negative indirect effect on both psychopathy and Machiavellianism through MT. The statistical model suggests that subclinical narcissism could increase MT contributing indirectly to positive outcomes across achievement contexts.”

Comment 5: In section 1.4 maybe the authors better use the term "correlate" instead of "associate" when they describe their hypothesis.
Response: We have amended the hypotheses based on reviewer’s comment:

“Specifically, we hypothesised that:

1. MT will correlate positively with subclinical narcissism in adolescence

2. MT and subclinical narcissism will correlate positively with school achievement

3. MT, narcissism and achievement will associate to each other longitudinally and will show high stability over time.

4. Narcissism will exert a positive indirect effect on school achievement through MT.”

Comment 6: Page 9: When describing the short form of the mental toughness questionnaire by selecting 10 items out of the 48 of the original by Clough et al. (2002) it is not clear on what basis they were selected or how they were selected? Also, the authors should mention here the coefficient alpha and/or the retest reliability of that scale (I am not happy with putting so much (essential) information in the supplementary material; see also my next point).

Response: To address these comments we have added the following text in section 2.3.1 of the revised manuscript: “The 12-item measure derived by taking the two highest line adding items of the MTQ48 in each of the six sub scales. We then performed a Confirmatory Factor Analysis (CFA) on the 12-item measure and resulted in the 10-item version due to poor factor loading for two of the 12 items. The initial CFA on the resultant 12 items from EFA provided unsatisfactory data-model fit on all indices but SRMR, χ² (54, N = 343) = 185.87, p < .001, CFI = .82, IFI = .82, SRMR = .07, RMSEA = .09 (CI of .08 to .11). An inspection of factor loadings revealed that item 7 and item 11 loaded poorly on the general factor (.27 and .22 respectively), and below the recommended threshold of .32 (see Tabachnick & Fidell, 2001). Removal of these items resulted in an improved model fit. The statistical analysis that was conducted to validate this new measure is described in detail in section the Supplementary Material.”
As per the reviewer’s suggestion we have also placed Table 1 (section 3.1) in the main part of the manuscript to present test-retest reliabilities for Mental Toughness, Narcissism, School Grades and School Achievement.

**Comment 7:** In general and most importantly I was puzzled to find almost a second paper in the supplementary material (the paper is 17 pages, the supplement 13 pages); this is not my understanding of the function of supplementary material; I found it very unusual to include so much written text and even another reference list in the supplement (but finally this is for the editor to decide). There are several aspects, especially the test-retest reliabilities, alphas and so on as well as the information on the intelligence test that must be included in the main part of the paper and not in the supplementary material. In this context, see Page 10, section 3.2: I would suggest to include the information that is given in tables S1 and table S2 within the regular tables of the paper.

**Response:** We have moved tables S1 and S2 from the supplementary material to the main part of the paper. These tables appear now as tables 1 (Section 3.1) and 2 (Section 3.2), respectively, in the main part of the paper. Please also see response to Reviewer 1 comment 1 above.

We have also reduced significantly the length of the supplementary material (from 13 pages, 3,063 words to 6 pages, 1,830 words).

**Comment 8:** Associations between mental toughness and school achievement are extremely low in terms of explained variance although they nevertheless reach significance (due to the large sample size, which is good). But it is not clear whether this is due to the fact, that the very short form of the mental toughness assessment employed here (only 10 instead of 48 items in the original version) does not cover all relevant variance of that construct? To assess this, it would really be necessary to have much more detailed information on how the short version was constructed. Either 10 out of 48 items are simply not enough to cover relevant variance of that construct, or alternatively, mental toughness is simply a construct that does not account for much of school achievement in the age group tested here (as it is reasonably argued in the discussion). It should be outlined more clearly what speaks in favor of which interpretation (and this must be done in the main part of the paper and not the supplement).
**Response:** We have made a number of changes in response to this comment. Please see responses to comments 6 and 7 above.

In addition, we have altered the following paragraph in the discussion to posit the view that the weak association between MT and school achievement may be the product of using the short measure of MT; but most importantly the product of using a measure of school achievement that does not capture the full amount of variation in school grades: “We do think however that MT has an important role to play in school achievement. A possible explanation for the difference between the current findings and previous research is differences in the measures that were used in this study and in previous studies. Specifically, the short measure of MT (MTQ-10) may not capture the full amount of individual variation on MT offering lower explanatory power in relation to performance outcome. More importantly, however, we think that the scale of self-reported school grades is not sensitive enough to capture the full amount of variation that exists in the lower end of the distribution (the scale ranges from 4 to 10 where 4 represents any score from 0 to 4). Future studies could assess longitudinally total MT and the 4Cs and employ additional measures of school achievement in order to test the predictive power of MT on school performance.”

**Comment 9:** Page 13: I cannot follow the argumentation in paragraph 2, namely that “… it suggests that some non-cognitive traits are more relevant to performance in certain aspects of academic attainment”). What does this mean? More relevant compared to what?

**Response:** We meant to suggest that MT might have a more important role to play in certain educational outcomes (e.g. literacy) as compared to others (e.g. mathematics). We have rephrased this sentence to make this clear: “This finding requires further investigation as it suggests that MT may be more relevant to certain aspects of academic attainment (such as in literacy) as compared to others (such as in mathematics).”

**Comment 10:** It is good that the authors introduced cognitive ability as a control variable; maybe the authors could report on how much the original relations between mental toughness at wave
1 and school achievement at wave 2 were reduced when introducing a cognitive ability as a control variable. I presume that cognitive ability took away much of that variance?

**Response:** Indeed, cognitive ability took away much of the variance on school achievement that was predicted by MT. We have added the following sentence in section 3.2 of this revised manuscript: “When cognitive ability was excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased significantly ($\beta = .19$, $R^2 = .032$, $p < .01$).”

**Comment 11:** Page 15: I am not sure what the authors mean by "… suggesting that the joint manifestation of high narcissism and high MT relates to positive outcomes": I haven't looked into the paper of Papageorgiou, the authors refer here to, but I ask myself what this conclusion means? The formulation of a "joint manifestation" could in my view rather be read as an interactive effect where high narcissism and high mental toughness coming together produce a multiplicative effect (not only an additive effect).

**Response:** We have rephrased this sentence to be more accurate: “This is in line with recent findings (see Papageorgiou et al., 2017) suggesting that subclinical narcissism may increase MT, a trait that is relevant across achievement contexts, contributing indirectly to positive outcomes.”

**Comment 12:** Page 16: I can follow the authors’ tendency to cut out narcissism from the dark triad; and arguing in favor of a more bright trait, but the statement in the last sentence of the paper sounds to me much too strong, given the many report of negative effects of narcissism reported in the literature. A single paper like this one - that moreover did not really show any important influence of narcissism with respect to school achievement - cannot serve as a basis of putting away narcissism from the dark traits in personality psychology.

**Response:** We did not aim to suggest that narcissism should be excluded from the dark triad of personality. Instead, we want to suggest that the context, where a personality trait is expressed is important and should be taken under consideration. We have rephrased this last sentence to read: “The current findings do not provide strong evidence for excluding subclinical narcissism from the dark triad of personality traits. However, the notion that scoring high on subclinical narcissism may
increase school performance, through MT, supports the idea of studying the contextual adaptive and maladaptive aspects of traits; instead of focusing on rigid dichotomies between prosocial versus socially malevolent personality traits."

Additional minor comments:

- The name Vaselka is misspelled throughout the manuscript, it must be Veselka.

  Response: This has been amended.

- p. 6: 'used as sample of twins' should probably read as "used a sample of twins …"

  Response: This has been amended.

- p. 8, 1st sentence: "… are described IN Section 1 …"

  Response: This has been amended.

- In the references some of the papers are not listed properly (e.g. volume and page numbers missing, like in Dumfart & Neubauer, 2016 and others)

  Response: These have been amended.
Longitudinal Associations between Narcissism, Mental Toughness and School Achievement

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Conflict of interest

All authors declare no conflicts of interest.

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Author Contributions

K.A.P. has written the manuscript with the contribution of M.M. and A.D.; K.A.P., M.M. and A.D. have performed the statistical analyses; M.M., N.S. and K.S. were responsible for data collection and data preparation; P.J.C. and Y.K. provided critical reviews and comments during the write-up of this manuscript. K.A.P. was responsible for the conceptualisation of the study that is presented in this manuscript; M.M., N.S. and K.S are the directors of the MILES project.
• Mental Toughness correlated positively with subclinical narcissism in adolescence
• Mental Toughness predicted a small percentage of the variation in school achievement
• Narcissism exerted a significant positive indirect effect on school achievement through MT
• MT, narcissism and achievement were all highly stable over time
• Inclusion of narcissism in the dark triad of personality traits may need to be reconsidered
Longitudinal Associations between Narcissism, Mental Toughness and School Achievement
Abstract

Mental Toughness has been associated with optimal performance across diverse contexts including academic achievement. MT is positively associated with subclinical narcissism. Cross-sectional research reported that high narcissism may contribute indirectly to enhanced positive outcomes, through MT. This study is the first to explore longitudinally the development of the association between MT, narcissism and achievement in a sample of adolescents. MT correlated positively with narcissism and predicted a small percentage of the variation in school achievement. Narcissism did not correlate significantly with school achievement. However, subclinical narcissism exerted a significant positive indirect effect on school achievement through MT. The findings suggest that the relationship between narcissism and MT could be one of the non-cognitive mechanisms that underlie individual variation in school achievement.

Keywords: longitudinal design, mental toughness, subclinical narcissism, school achievement.
1.0 Introduction

There is increasing interest in studying the role of non-cognitive traits in contributing to variation in academic attainment across development (e.g. Dumfart & Neubauer, 2016). Several non-cognitive traits have been identified as buffers against the negative impact of stressful situations on performance in education. These include grit (Duckworth, Peterson, Matthews, & Kelly, 2007); motivation (Lepper, Corpus, & Iyengar, 2005); resilience (McGeown, St Clair-Thompson, & Clough, 2016); and hardiness (Kobasa, 1979). Mental Toughness (MT) has been suggested as a construct that may subsume the aforementioned concepts (see Bahmani et al., 2016).

1.1 Mental Toughness, Learning and Educational Achievement

MT is a personality trait that includes an array of positive characteristics such as perceiving challenge as an opportunity rather than a threat and feeling in control of life situations (Clough, Earle, & Sewell, 2002). MT reflects an effective coping mechanism in reaction to stressors and it facilitates proactively seeking out opportunities for personal growth (St Clair-Thompson et al., 2015). MT correlates with personality traits that are established predictors of performance in diverse settings (Lin, Mutz, Clough, & Papageorgiou, 2017). For example, a study reported positive correlations between MT, extraversion, openness to experience, agreeableness, and conscientiousness; and negative correlations between MT and neuroticism (Horsburgh, Schermer, Veselka, & Vernon, 2009). Another study showed evidence for the existence of a general factor of personality representing high levels of MT, extraversion, and conscientiousness as well as low levels of neuroticism (Veselka, Schermer, Petrides, & Vernon, 2009).

Clough and colleagues (2002) characterised MT as a composite of four (the 4Cs) strongly
correlated but independent subcomponents: (1) control (life and emotion): the tendency to feel and act as if one is influential and keep anxieties in check; (2) commitment: the tendency to be deeply involved in pursuing goals despite difficulties that arise; (3) challenge: the tendency to see potential threats as opportunities for self-development and to continue to strive in changing environments; and (4) confidence (in abilities and interpersonal): the belief that one is a truly worthwhile person in spite of setbacks, and the ability to push oneself forward in social settings.

Previous research has shown that MT is an important concept for explaining individual differences in learning and educational performance (McGeown et al., 2016). For example, positive correlations were found between total MT, academic attainment (r = .22), attendance (r = .22; St Clair-Thompson et al., 2015), social inclusion (r = .22) and social acceptance (r = .38) in adolescents (St Clair-Thompson et al., 2015). Another study showed that MT was correlated negatively with oppositional behaviour (r = -.23), inattention (r = -.17) and hyperactivity (r = -.14) in adolescents (St Clair-Thompson et al., 2015).

Individual differences in MT also associate with individual variation in undergraduate students’ performance in learning and education. For example, a study reported positive correlations between MT, grades and progression (r = .31 and r = .25, respectively; Crust et al., 2014) in undergraduate students. Positive associations were also reported between MT and positive emotions ($R^2 = .75$), thriving ($R^2 = .87$), and academic ($R^2 = .53$) and social goal progress ($R^2 = .45$) over 10 weeks in undergraduates (Gucciardi, Hanton et al., 2015). Another study reported that the 4Cs were positively associated with self-esteem ($r = .23$ for the subscale of control of emotions to .83 for the subscale of confidence) and college adjustment ($r = .19$ to .70); and negatively associated with school concerns ($r = -.27$ to -.52) in undergraduate students.
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(St Clair-Thompson et al., 2015). The particularly high correlation between self-esteem and confidence (reported in St Clair-Thomson et al., 2015) is to be expected and it has been acknowledged by a number of authors and approaches (e.g. Cashmore, 2002; Crust, 2008). However, MT represents a number of additional (to self-esteem) psychological constructs including *Seeking out challenge; Motivation to achieve; Persistence* and *Resilience* (Clough et al., 2002).

Recently a study explored the association between MT and academic grades and attendance in a sample of university students. Commitment and control together accounted for 16.5% of the variance in total average grade (Lin et al., 2017). These studies suggest that MT is an important trait in relation to educational outcomes with implications for educational practice.

1.2 Narcissism and Mental Toughness

Subclinical narcissism includes facets retained from the clinical syndrome, namely grandiosity, entitlement, dominance, and superiority (Paulhus & Williams, 2002). Previous studies suggested that narcissism might be unique among the DT traits in that, it encapsulates to a larger extent (in comparison to psychopathy and Machiavellianism), prosocial and adaptive behaviours (e.g. Veselka et al., 2012). Petrides et al. (2011) used a sample of twins and reported that—unlike psychopathy and Machiavellianism—narcissism correlates positively (*r* = .20 for twin 1 and *r* = .22 for twin 2) with emotional intelligence. The authors suggested that the heightened sense of self-worth may render a narcissist optimistic, motivated, assertive, and successful in relationships (Petrides et al., 2011).

Three studies have explored the relationship between subclinical narcissism and MT in adults (Onley et al., 2013; Sabouri et al., 2015; Papageorgiou, Wong, & Clough, 2017). All three
studies reported significant and positive associations between the two traits ($r = .13 - .21$ between the 4Cs and narcissism; $r = .50$ for total MT and narcissism; $r = .21$ for total MT and narcissism, respectively). Furthermore, Papageorgiou et al. (2017) showed that, despite being part of the dark triad, narcissism exerted a significant negative indirect effect on both psychopathy and Machiavellianism through MT. This statistical model suggests that subclinical narcissism could increase MT contributing indirectly to positive outcomes.

1.3 The Current Study

The current study aimed to: (1) Extend previous findings, derived from adult samples, on the association between subclinical narcissism and MT in an adolescent sample; (2) Explore longitudinally the degree to which individual differences in MT and subclinical narcissism predict individual variation in school achievement; (3) Test a mediation model suggesting that narcissism increases MT, which subsequently contributes to higher school achievement. We hypothesised that:

1. MT will correlate positively with subclinical narcissism in adolescence.
2. MT and subclinical narcissism will correlate positively with school achievement.
3. MT, narcissism and achievement will associate to each other longitudinally and will show high stability over time.
4. Narcissism will exert a positive indirect effect on school achievement through MT.

2.0 Method

2.1 Sample
Participants are part of the Multi-Cohort Investigation into Learning and Educational Success (MILES). Wave 1 and Wave 2 (\(N = 927\) and \(N = 561\), respectively after data cleaning and screening) include students recruited from three different Italian high schools in the Milan Province. The present investigation includes students who participated in MILES at both wave 1 (March 2016) and wave 2 (June 2016). In total 339 students took part in both collection waves (54% females). Participants’ ages ranged between 14 and 21 (\(M = 15.63, SE = 1.40\), in wave 1 and \(M = 15.83, SE = 1.40\), in wave 2). Students with a diagnosis of learning difficulties were excluded from the current analyses. MILES received ethical approval from XXXXXXXXXXXX and the parents’ and teachers’ committees of every school that approved the MILES protocol.

2.2 Procedure

All students were invited to take part in the study. The data were collected online using the forepsyte.com online platform (www.forepsyte.com). Students took part in both testing sessions at home or on the school’s computers after classes. Participants were given an individualised ID, which they used to access the web study. The ID codes and corresponding names are stored in a separate secure server from the rest of the data. An information sheet, consent form and debrief form were included at both collection waves. The first wave lasted around 90 minutes; the second wave around 45 minutes.

2.3 Measures

2.3.1 Mental Toughness. The newly developed ten-item Mental Toughness Questionnaire (MTQ-10) has been used to assess total MT at wave 1 and wave 2. Originally, a 12-item measure derived by taking the two highest line adding items of the MTQ48 in each of the six sub scales. We then performed a Confirmatory Factor Analysis (CFA) on the 12-item
measure and resulted in the 10-item version due to poor factor loading for two of the 12 items. The initial CFA on the resultant 12 items from EFA provided unsatisfactory data-model fit on all indices but SRMR, $\chi^2 (54, N = 343) = 185.87, p < .001, CFI = .82, IFI = .82, SRMR = .07$, $RMSEA = .09$ (CI of .08 to .11). An inspection of factor loadings revealed that item 7 and item 11 loaded poorly on the general factor (.27 and .22 respectively), and below the recommended threshold of .32 (see Tabachnick & Fidell, 2001). Removal of these items resulted in an improved model fit. The statistical analysis that was conducted to validate this new measure is described in detail in the Supplementary Material.

The MTQ-10 has an average completion time of 5 minutes with responses to its 10 items given on a 5-point Likert scale anchored at $1 = strongly disagree$ and $5 = strongly agree$. Three items are reverse coded; the MT score represents the average score of the 10 items. Example item include “I generally cope well with any problems that occur”.

2.3.2 Narcissism. The Short Dark Triad questionnaire (SD3) assesses subclinical narcissism, subclinical psychopathy and Machiavellianism and it has high reliability and validity, including construct validity and external validity (Jones & Paulhus, 2014). The SD3 includes 27 items, 9 for each scale with responses given on a 5-point Likert scale, with $1 = strongly disagree$ and $5 = strongly agree$. We used only the 9 items that assess subclinical narcissism. Example items include: “People see me as a natural leader”. The score for the subscale represents the average score of the 9 corresponding items.

2.3.3 School Grades. Students reported their grades in mathematics, literacy (Italian) and second language at the end of the first term (wave 1) and the second term (wave 2). Students’ grades ranged from 4 to 10, where 10 indicated the highest possible grade, 6 represented pass, and 4 indicated a grade of 4 or lower. A mean composite score of the grades reported in
mathematics, literacy and second language was created as a measure of overall school achievement. Self-reported grades are regarded as a reliable measure of school achievement (Kuncel, Crede, & Thomas, 2005).

2.3.4 Cognitive Ability Measures. Students’ cognitive ability was used as a covariate in the analyses. A 30-item online version of the Raven's Progressive Matrices test (Raven, Court, & Raven, 1996) was administered to assess non-verbal reasoning. The items were arranged in increasing level of difficulty. A discontinue rule was applied so that after three consecutively incorrect responses in one subsection, participants were re-directed to the next subsection.

The newly developed Italian Vocabulary Test (IVT-80; Malanchini et al., in preparation) was used to assess verbal ability. The test consisted of 80 items and it is loosely based on the Mill Hill vocabulary test (Raven, Raven, & Court, 1998). For every item, participants were presented with a word, and they were asked to select a synonym of that word, out of six options. Only one option was the correct one. The items were presented in order of frequency in the written Italian language, from words appearing more frequently, to words with appearing less frequently. For example, the word "Motive" was presented together with six possible synonyms: (a) leader, (b) activity, (c) change, (d) motion, and (e) reason – with option ‘e’ being the correct answer. A short version of the IVT including 35 items (IVT-35) was included at wave 2. The IVT showed good test-retest correlation over 4 months ($r = .66, N = 339$). The test and the reduced version both showed reasonable external validity as they shared moderate correlations with literacy school achievement ($r = .36, N = 922$ at wave 1; and $r = .40, N = 522$ at wave 2) and non-verbal reasoning ($r = .42, N = 922$). A mean composite score of the two tests was taken as an index of cognitive ability.

3.0 Results
3.1. Descriptive Statistics

Descriptive statistics for MT, subclinical narcissism, school grades and school achievement are presented in Table S1 in the Supplementary Material. Table 1 presents test-retest reliabilities for MT, subclinical narcissism, school grades and school achievement.

*Table 1 should be placed here*

3.2. Associations between Mental Toughness, Narcissism and School Achievement

Table 2 presents the correlations between school grades for wave 1 and wave 2, respectively.

*Table 2 should be placed here*

Partial correlations (controlling for age and sex) showed that subclinical narcissism (wave 1) correlated positively with MT at wave 1 ($r = .38, p < .001, 95\% \text{ CI} [0.28, 0.47]$). Subclinical narcissism (wave 2) correlated positively with MT at wave 2 ($r = .34, p < .001, 95\% \text{ CI} [0.23, 0.45]$).

Multiple linear regression (controlling for age, sex and cognitive ability) was used to explore the associations between MT and narcissism at wave 1 and wave 2 with school achievement (wave 1 and wave 2, respectively). Longitudinal associations between MT (wave 1) with grades in mathematics (wave 2), literacy (wave 2) and second language (wave 2); and between narcissism (wave 1) with grades in mathematics (wave 2), literacy (wave 2) and second language (wave 2) are presented in the supplementary material in Tables S2 and S3, respectively.
MT at wave 1 was associated significantly with school achievement at wave 1 ($\beta = .10$, $R^2 = .01, p < .05$). MT at wave 2 was associated significantly with school achievement at wave 2 ($\beta = .13$, $R^2 = .016, p < .05$). MT at wave 1 was associated significantly with school achievement at wave 2 ($\beta = .11$, $R^2 = .012, p < .05$). When all covariates were excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased ($\beta = .16$, $R^2 = .026$, $p < .01$). When cognitive ability only was excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased significantly ($\beta = .19$, $R^2 = .032$, $p < .01$). Narcissism at wave 1 was not associated significantly with school achievement at wave 1 ($\beta = -.02$, $R^2 = .00, p = .67$). Narcissism at wave 2 was not associated significantly with school achievement at wave 2 ($\beta = .009, R^2 = .00, p = .85$). Narcissism at wave 1 was not associated significantly with school achievement at wave 2 ($\beta = -.03, R^2 = .001, p = .55$).

Table 3 should be placed here

3.3 Cross-lagged Analysis

Figure 1 presents a cross-lagged model exploring the longitudinal relations between narcissism, MT and school achievement across the two collection waves. All variables were age regressed and standardised prior to model fitting. The model was a good fit for the data ($CFI = 1.00$, $TLI = 1.00$, $RMSEA = .000$, $SRMR = .00$). MT was found to be stable over time ($\beta = .727, p < .001$), and strong stability was also observed for school achievement ($\beta = .822, p < .001$) and narcissism ($\beta = .685, p < .001$). The concurrent relation between MT and narcissism at wave 1 was moderate ($r = .424, p < .001$). The two variables also shared a modest correlation at wave 2 beyond their correlation at wave 1 ($r = .232, p < .001$). The correlation between MT and achievement at wave 1 was weak but significant ($r = .147, p < .001$), and the two constructs
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shared a weak correlation at wave 2 ($r = .138, p < .01$). Narcissism and achievement were not correlated at wave 1, but they shared a weak association at wave 2 ($r = .135, p < .01$).

*Figure 1 should be placed here*

3.4 Mediation Effect of Mental Toughness on Narcissism and School Achievement

The absence of a direct association between narcissism and achievement does not preclude the possibility that they are indirectly associated though their mutual relation with MT. Figure 2 illustrates our proposed mediation model: In line with the hypothesis, the indirect effect of narcissism (Wave 1) on school achievement (Wave 2), through individual differences in MT (Wave 2), was positive and statistically significant ($b = 0.08, SE = 0.03, 95\% CI [0.032, 0.162]$).

*Figure 2 should be placed here*

4.0 Discussion

The present study explored longitudinally the contribution of MT and subclinical narcissism in educational achievement. The results extended previous cross-sectional findings in adult samples (e.g. Papageorgiou et al., 2017) showing a positive and moderate association between MT and subclinical narcissism, across both collection waves, in an adolescent sample. This finding provides further support to previous evidence (see for example, Onley et al., 2013) indicating that narcissism encapsulates prosocial and adaptive behaviours.

The results also showed that MT associates positively with school achievement. Additional analysis on the association between MT and school grades showed that MT associates more strongly with school grades in literacy than in mathematics and foreign language. This finding requires further investigation as it suggests that MT may be more relevant to certain
aspects of academic attainment (such as in literacy) as compared to others (such as in mathematics). However, the variance in school achievement and grades that was explained by MT was very small, which poses difficulties in terms of making inferences about the practical value of these results. It is possible that non-cognitive traits, such as MT, may be stronger predictors of academic performance in higher education in comparison to lower levels of education. This could be due to the fact that university samples tend to exhibit less individual variation in intellectual ability as a result of students being selected on the basis of similar academic performance in high school (Furnham, Chamorro-Premuzic, & McDougall, 2002).

We do think however that MT has an important role to play in school achievement. A possible explanation for the difference between the current findings and previous research is differences in the measures that were used in this study and in previous studies. Specifically, the MTQ-10 may not capture the full amount of individual variation on MT offering lower explanatory power in relation to performance outcome. More importantly, however, we think that the scale of self-reported school grades is not sensitive enough to capture the full amount of variation that exists in the lower end of the distribution (the scale ranges from 4 to 10 where 4 represents any score from 0 to 4). Future studies could assess longitudinally total MT and the 4Cs and employ additional measures of school achievement in order to test the predictive power of MT on school performance.

Cross-lagged analyses showed that MT, narcissism and achievement were all highly stable over time, which is indicative of the reliability of these constructs. The correlations between measures were significant beyond those observed at wave 1; this finding may suggest that the observed associations grow over time. The cross-lagged links between all constructs were not significant. This suggests that, even if the associations between MT, narcissism and
achievement grow over time; this growth is not a function of their direct mutual influences on each other. Other factors, for example conscientiousness and openness to experience may influence the longitudinal association between MT and narcissism.

Mediation analysis showed that subclinical narcissism was positively associated with MT, which in turn was associated with higher school achievement. This is in line with recent findings (see Papageorgiou et al., 2017) suggesting that subclinical narcissism may increase MT, a trait that is relevant across achievement contexts, contributing indirectly to positive outcomes. Future studies could explore the role of MT and narcissism in other aspects of life, such as for example relationships, career aspirations and professional satisfaction.

The findings of the present research should be interpreted in light of some limitations. Responses in self-reported data may be influenced by common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and social desirability, particularly in the context of the assessment of a “dark” trait (narcissism). Data collection from multiple raters could enhance the validity of the results. Moreover, scores for narcissism obtained using the SD3 might be biased towards assessing narcissism as a prosocial trait, linked to healthy self-esteem, rather than assessing the antisocial aspects of narcissism. Maples, Lamkin and Miller (2014) suggested that the SD3 narcissism scale measures primarily the grandiose aspects of this construct; while other short measures of this trait, such as the Dirty Dozen (Jonason & Webster, 2010) might capture both vulnerable and grandiose features of narcissism. Finally, the generalizability of the findings might be limited to the educational system of the country from which the sample has derived; future studies could attempt to replicate the results using cross-cultural data.
McGeown et al. (2016) have proposed recently that future research focusing on MT should make efforts to overcome some of the methodological weaknesses (e.g. lack of longitudinal data) to allow a greater and more comprehensive understanding of this concept within education. The current study presents novel findings on the stability of individual differences in MT and subclinical narcissism over the course of a school year. The findings do not provide strong evidence for excluding subclinical narcissism from the dark triad of personality traits. However, the notion that scoring high on subclinical narcissism may increase school performance, through MT, supports the idea of studying the contextual adaptive and maladaptive aspects of traits; instead of focusing on rigid dichotomies between prosocial versus socially malevolent personality traits.
References


NARCISSISM, MENTAL TOUGHNESS AND SCHOOL ACHIEVEMENT


NARCISSISM, MENTAL TOUGHNESS AND SCHOOL ACHIEVEMENT


Table(s)

Tables

Table 1. Test-Retest Reliabilities for Mental Toughness, Narcissism, School Grades and School Achievement

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mental Toughness 2</th>
<th>Narcissism 2</th>
<th>Mathematics 2</th>
<th>Literacy 2</th>
<th>Second Language 2</th>
<th>School Achievement 1</th>
<th>School Achievement 2</th>
</tr>
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<tbody>
<tr>
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<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
</tr>
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<td>—</td>
<td>.73***</td>
<td>—</td>
<td>—</td>
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</tr>
<tr>
<td>Literacy 1</td>
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<td>—</td>
<td>—</td>
<td>.73***</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>Second Language 1</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>.76***</td>
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<td>—</td>
<td>—</td>
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<td>.83***</td>
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Note:  N = 339; ***p ≤ .001. Standard deviations are given in parentheses. Numbers 1 and 2 after variable names refer to the assessment waves.
Table 2. Correlations between School Grades at Wave 1 and Wave 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mathematics 1</th>
<th>Literacy 1</th>
<th>Second Language 1</th>
<th>Mathematics 2</th>
<th>Literacy 2</th>
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<td>.45***</td>
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<td>.42***</td>
</tr>
<tr>
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<td>—</td>
<td>—</td>
<td>.56***</td>
<td>.46***</td>
<td>—</td>
<td>.54***</td>
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<td>—</td>
<td>—</td>
<td>.39***</td>
<td>.56***</td>
<td>—</td>
</tr>
<tr>
<td>Mathematics 2</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>.48***</td>
</tr>
<tr>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Second Language 2</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: *N = 339; ***p ≤ .001. Number 1 after the name of a variable refers to the assessment of this variable at wave 1. Number 2 after the name of a variable refers to the assessment of this variable at wave 2.*
Table 3. Longitudinal Associations between Mental Toughness (Wave 1) and Narcissism (Wave 1) with School Achievement (Wave 2)

| N=339 |

<table>
<thead>
<tr>
<th>Independent Variable: Mental Toughness Wave 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
</tr>
<tr>
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<tr>
<td>School Achievement Wave 2</td>
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</table>

<table>
<thead>
<tr>
<th>Independent Variable: Narcissism Wave 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
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<tr>
<td>---------------------</td>
</tr>
<tr>
<td>School Achievement Wave 2</td>
</tr>
</tbody>
</table>

Note: The “B” and “β” refer to the unstandardized and standardized regression coefficients respectively.
Figure 1: Heat map presenting correlations between measures before and after residualizing for age and sex

Note. Narc = Narcissism; MTQ = Mental Toughness; Ach = Achievement; V = Verbal ability; NV = Non-verbal ability; 1 = Wave 1; 2 = Wave 2
Figure 2. Mediation Model of Narcissism (Wave 1) on School Achievement (Wave 2) through MT (Wave 2)

Figure 2. Mediation model of the indirect effect of narcissism (Wave 1) on school achievement (Wave 2) through MT. b’s represent the unstandardised regression coefficients (***p < .001; *p < .05). Total effect: $b = -0.052$, $SE = 0.089$, $p = .55$; (a) The effect of narcissism (Wave 1) on MT (Wave 2); (b) the effect of MT on school achievement (Wave 2) after controlling for narcissism; (c’) the direct effect of narcissism (Wave 1) on school achievement (Wave 2).
Supplementary Material

Section 1.

Statistical Analyses

Validating the New MTQ-10 Measure. Missing data were imputed by regression, considering that less than 5% of the data was missing. After screening the data, the sample was divided into two subgroups of wave 1 (W1) and wave 2 (W2) to verify the factor structure of the scale. Using AMOS 23 software, confirmatory factor analyses (CFA) were performed on the MTQ-10 initially with the W1 data to test the assumption that a single factor comprised the measure. The most plausible model from the W1 data was replicated using the W2 data to cross-validate the confirmed model. The validated model across W1 and W2 data was assessed for measurement invariance over time using multigroup CFA. Goodness of fit was evaluated through Chi-square, CFI (Comparative Fit Index), IFI (Incremental Fit Index), RMSEA (Root Mean Squared Error of Approximation) and SRMR (Standardized Root Mean Squared Residual). For these indices, literature suggests that values above .86 for CFI and IFI are marginal; values equal to or greater than .90 are deemed acceptable; and values close to 1 are indicative of good fit (Nigg, Nikolas, Miller, Burt, Klump, & von Eye, 2009). For RMSEA and SRMR, values of .08 and lower are considered optimal (Hair, Black, Babin, Anderson, & Tatham, 2009). For the initial factor structure assessment, modification indices (MI) were also examined to identify parameter misfit.

Through multigroup CFA, two models were tested: For the first model, parameters were freely estimated for each group, with only the plausibility of the factor structure tested. In the second model, factor loadings were constrained to be equal between groups. The CFI and chi-square differences between the models were considered. Finally, composite reliability (CR) was
calculated to determine the internal consistency of items in the factor structure. CR values above .60 are considered acceptable (Diamantopoulos & Siguaw, 2000). For completeness, Cronbach’s alpha was reported along with test-retest reliability from W1 to W2 responses. The intraclass correlation coefficient was used to assess test-retest reliability with values greater than .70 considered acceptable (Cicchetti, 1994).

**Descriptive Statistics and Covariates.** Demographics and questionnaire data were examined using Descriptive Statistics in SPSS Version 24 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Kurtosis and skewness, were calculated to test for normality in the distribution (skewness < 1.0). All variables were approximately normally distributed. Cronbach’s alphas were calculated to estimate the measures’ internal consistency (see Table S1 below for details).

Previous research (e.g. Marchant et al., 2009; Lin et al., 2017; Paulhus & Williams, 2002) has shown that age and sex influence MT and narcissism. In our sample males scored significantly higher than females on MT at wave 1 \( F (1, 338) = 35.34, p < .001, \eta^2 = .09 \) and wave 2 \( F (1, 338) = 21.44, p < .001, \eta^2 = .06 \); and on narcissism at wave 1 \( F (1, 338) = 18.50, p < .001, \eta^2 = .05 \) and wave 2 \( F (1, 338) = 14.36, p < .001, \eta^2 = .04 \). Age showed a very weak correlation with school achievement at wave 1 \( r = .11, p < .05 \). As such, age and sex were used as covariates in the partial correlation, multiple linear regression and mediation analyses. To explore whether subclinical narcissism and MT associate significantly with school achievement, when controlling for cognitive ability, a mean composite score of two cognitive tests (RPM and IVT-80) was used as a covariate in the aforementioned analyses.

**Correlations, Multiple Linear Regression, Cross-Lagged and Mediation Analyses.** Partial correlations were used to test the first hypothesis (MT will associate positively with
subclinical narcissism); multiple linear regressions were used to test the second hypothesis (MT and subclinical narcissism will associate positively with school achievement). Cross-lagged panel analysis was used to investigate the longitudinal associations between MT, narcissism and achievement across collection waves 1 and 2 (hypothesis 3). Cross-lagged analyses were run using the MPlus 7.0 software (Muthén & Muthén, 1998-2012). To test the fourth hypothesis, that individual differences in MT mediate the relationship between subclinical narcissism and school achievement, hierarchical regression analysis was performed using the PROCESS macro for SPSS (Version 2.13; Hayes, 2012). The direct effect provides an estimate of the effect of the independent variable (IV) on the dependent variable (DV). The indirect effect of the IV on the DV via a potential mediator (M) can be estimated from bias-corrected bootstrap 95% confidence intervals. The total effect provides an estimate of the combined direct and indirect effects. In the present study we used 5,000 bootstrap resamples.

Section 2.

MTQ-10 Psychometric Properties

A confirmatory factor analysis of the one-factor model for the MTQ-10 with the W1 data revealed unsatisfactory fit on all indices but SRMR, $\chi^2 (35, N = 343) = 147.88, p < .001$, CFI = .84, IFI = .84, SRMR = .07, RMSEA = .09 (CI of .08 to .11). An inspection of modification indices (MI) revealed that allowing within-item error correlations between items 4 and 9, 2 and 8, 2 and 3, and 3 and 8 would improve model fit, $\chi^2 (31, N = 343) = 98.33, p < .001$, CFI = .90, IFI = .90, SRMR = .05, RMSEA = .08 (CI of .06 to .09). Byrne (2016) recommends that item errors should not be correlated unless there exists appropriate justification. In this case, a rationale existed given items 4 and 9 both belonged to the Challenge subscale from the initial MTQ-48; and items 2, 8, and 3 were all reverse-scored items representing a degree of
commonality in item phrasing. The suitability of the one-factor model can be further supported in relation to its factor loadings, as all items loaded higher than the minimum threshold of .30 (Brown, 2015) apart from items 2 and 3 (loadings of .28 and .23 respectively). This final model including within-item correlations was specified and tested with the W2 data, and revealed acceptable fit, thus validating the one-factor structure of the model, \(\chi^2(31, N = 343) = 95.94, p < .001, \text{CFI} = .91, \text{IFI} = .91, \text{SRMR} = .06, \text{RMSEA} = .07\) (CI of .06 to .09). As with the W1 data, all items loaded higher than the minimum threshold of .30 apart from items 2 and 3 (loadings of .22 and .18 respectively).

The multigroup CFA compared W1 with W2 data to verify the equivalence of parameters across time. The multigroup analyses indicated acceptable fit for the model with parameters freely estimated, \(\chi^2(64, N = 343) = 202.76, p < .001, \text{CFI} = .90, \text{IFI} = .90, \text{SRMR} = .05, \text{RMSEA} = .06\) (CI of .05 to .07). The model with constrained factor loadings suggested acceptable fit, \(\chi^2(71, N = 343) = 215.31, p < .001, \text{CFI} = .90, \text{IFI} = .90, \text{SRMR} = .06, \text{RMSEA} = .06\) (CI of .05 to .06). The difference between the CFI indices did not exceed .01. Also, a chi-square (\(\chi^2\)) difference test revealed a non-significant difference between models: \(\chi^2(7, N = 343) = 12.55, p = .08\), suggesting that both the factor structure of the scale and the factor weights of the items are similar between W1 and W2. Composite reliability values for the final one-factor solution were acceptable (greater than .60) for both W1 (\(\rho_c = .77\)) and W2 (\(\rho_c = .73\)). Cronbach’s alpha additionally indicated good internal consistency for W1 (\(\alpha = .76\)) and W2 (\(\alpha = .75\)). The test-retest intraclass correlation coefficient comparing W1 and W2 was .75 (CI of .70 to .80), indicating acceptable reliability of the measure over time. Overall, the results provide support for the suitability and stability of the one-factor solution of the MTQ-10.
Table S1. Descriptive Statistics for Mental Toughness, Subclinical Narcissism and School Grades (Wave 1 and Wave 2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Variance</th>
<th>Median</th>
<th>Range</th>
<th>Kurtosis</th>
<th>Skewness</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Toughness 1</td>
<td>3.22 (.54)</td>
<td>.30</td>
<td>3.18</td>
<td>2.91</td>
<td>.07</td>
<td>-.05</td>
<td>.76</td>
</tr>
<tr>
<td>Mental Toughness 2</td>
<td>3.18 (.55)</td>
<td>.30</td>
<td>3.18</td>
<td>3.36</td>
<td>.71</td>
<td>.07</td>
<td>.75</td>
</tr>
<tr>
<td>Narcissism 1</td>
<td>2.86 (.53)</td>
<td>.29</td>
<td>2.77</td>
<td>3.56</td>
<td>.46</td>
<td>.29</td>
<td>.65</td>
</tr>
<tr>
<td>Narcissism 2</td>
<td>2.90 (.58)</td>
<td>.33</td>
<td>2.88</td>
<td>3.11</td>
<td>.35</td>
<td>.20</td>
<td>.69</td>
</tr>
<tr>
<td>Mathematics 1</td>
<td>6.54 (1.44)</td>
<td>2.07</td>
<td>7.00</td>
<td>6.00</td>
<td>-.68</td>
<td>-.05</td>
<td>—</td>
</tr>
<tr>
<td>Mathematics 2</td>
<td>6.80 (1.25)</td>
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<td>7.00</td>
<td>6.00</td>
<td>-.34</td>
<td>-.001</td>
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<tr>
<td>Literacy 1</td>
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<td>5.00</td>
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<td>.23</td>
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<td>.97</td>
<td>7.00</td>
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<td>-.049</td>
<td>-.005</td>
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<tr>
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<td>5.00</td>
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<td>-.03</td>
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<tr>
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<td>School Achievement 1</td>
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</table>

Note: N = 339. Standard deviations are given in parentheses. Numbers 1 and 2 after variable names refer to the assessment waves.

Table S2. Multiple Linear Regressions between Mental Toughness at Wave 1 and School Grades at Wave 2

N=339

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>B</th>
<th>β</th>
<th>t</th>
<th>95% CI for β Lower Bound</th>
<th>95% CI for β Upper Bound</th>
<th>R²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics (Wave 2)</td>
<td>.21</td>
<td>.08</td>
<td>1.45</td>
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<td>.50</td>
<td>.006</td>
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<td>.15</td>
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<td>.08</td>
<td>.45</td>
<td>.02</td>
<td>.004</td>
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<tr>
<td>Foreign Language (Wave 2)</td>
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<td>.04</td>
<td>.80</td>
<td>-.14</td>
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<td>.002</td>
<td>.42</td>
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</table>

Note: The “B” and “β” refer to the unstandardized and standardized regression coefficients respectively.

Table S3. Multiple Linear Regressions between Narcissism at Wave 1 and School Grades at Wave 2

N=339

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<tr>
<th>Dependent Variable</th>
<th>B</th>
<th>β</th>
<th>t</th>
<th>95% CI for β Lower Bound</th>
<th>95% CI for β Upper Bound</th>
<th>R²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics (Wave 2)</td>
<td>-.22</td>
<td>-.08</td>
<td>-1.57</td>
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<td>.05</td>
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</tr>
<tr>
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<td>.15</td>
<td>.08</td>
<td>1.63</td>
<td>-.03</td>
<td>.33</td>
<td>.007</td>
<td>.10</td>
</tr>
<tr>
<td>Foreign Language (Wave 2)</td>
<td>-.04</td>
<td>-.018</td>
<td>-.35</td>
<td>-.27</td>
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<td>.00</td>
<td>.72</td>
</tr>
</tbody>
</table>

Note: The “B” and “β” refer to the unstandardized and standardized regression coefficients respectively.
References


