MASTER THESIS

The Impact of New Features on Perceived Usefulness, Perceived Ease of Use, Motivation and Satisfaction on a Discussion Forum in a Learning Management System.

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Keywords: knowledge steward, knowledge steward notification, perceived ease of use, perceived usefulness, motivation, satisfaction, discussion forum, learning management systems, Moodle, YouTube, Twitter.

FOREWORD

This thesis has been written to satisfy one of the many criteria for a Master thesis programme in Educational Science and Technology at the University of Twente.

My first thanks go to the ALMIGHTY GOD for my life, His love and mercies that have made me live to see this day come to pass. My profound gratitude to my supervisors, Drs. Henny H. Leemkuil and Lars Bollen for their effort, time and guidance throughout the writing process.

I am grateful to all the participants who spent their valuable time to take part in the experiment, you made this thesis possible in many ways. It was difficult to get participants in the beginning but I approached you as a stranger and you were willing and nice to take part in the experiment!

My gratitude to the University of Twente and all the professors whom I have gotten the opportunity to meet and part take in their lectures.

Finally, to all my friends and family especially Nasha.

Maxwell Kyei Baffour
31-07-2017

SUMMARY

Universities use Learning Management Systems with tools such as discussion forums, chats and emails to supplement education for students. Of these tools, discussions forums provide the closest to face-to-face interactions as existing in the regular school. Despite these advancements, many people still feel lonely, less motivated and satisfied with online education leading to an increase in attrition. Existing research only compare motivation, satisfaction and the effectiveness of online education with that of the regular school. These comparisons seem to suggest minor differences between the effectiveness of online education and regular school but reveal vast disparity in motivation and satisfaction. This paper considers if the introduction of a Knowledge Steward and Knowledge Steward Notification features in a discussion forum could affect perceived usefulness, perceived ease of use, motivation (Challenge, Interest, Probability of Success and Anxiety) and satisfaction positively. The study applied a one-way Analysis of Variance to compare means between groups to ascertain the Perceived Usefulness, Perceived Ease of Use, motivation and satisfaction levels of the control condition, a condition with a Knowledge Steward feature and another condition with the Knowledge Steward and Knowledge Steward Notification features. The outcome showed no significant differences in the conditions.

The Impact of New Features on Perceived Usefulness, Perceived Ease of Use, Motivation and Satisfaction on a Discussion Forum in a Learning Management System.

Technologies have improved education through applications and the internet creating access to courses for millions to learn while remaining in their homes across the world (Davis, 2014). Known as online education or e-learning, many universities use it to supplement teaching and learning (Davis, 2014; Young, 2002) and to gain a competitive advantage over others (Sánchez & Hueros, 2010). Reigle (2015) believed that "e-learning facilitates a new way of learning at a time when changes in technology have influenced the demands made on educators and workers" (p. 4).

In e-learning, learning takes place in online learning environments such as Moodle, Blackboard or Canvas. Also known as Learning Management Systems (LMS), they make learning possible anytime and anywhere when connected to the internet (Sánchez & Hueros, 2010). Evidence suggests that these learning environments may help students by promoting collaboration and knowledge application better than face-to-face classrooms (Tucker et al., 2014). These learning environments help students to overcome shyness and to express themselves better by providing some level of anonymity (Mokoena, 2013).

However, there are reports of increasing attrition (Boton & Gregory, 2015) attributed to students feeling isolated, lacking motivation and satisfaction in online education. There is also the lack of information among students (Kear et al., 2014) and teachers (Boton & Gregory, 2015; Gütl et al., 2014) resulting in only 10% successful completion of the total number of students who enrol in an online education (Gütl et al., 2014). Further research proves that the lack of discussion and collaborative activities hinders attention and erodes motivation, ultimately creating a setting that negatively affects participation leading to withdrawal from the course (Cull, Reed, & Kirk, 2010; Reigle, 2015; Roper, 2007).

Discussions forums serve as the space for engagements and interactions in courses in most online learning (Akers, 1997) and the activities in them may have resulted in the feeling of isolation, reducing motivation and increasing attrition. The interactions Hammond (2005) observed are an important element to achieving learning in the online environments. Also through discussions forums, instructors guide and support learning and knowledge construction (Albion & Ertmer, 2004; Smart & Cappel, 2006; Tucker et al., 2014).

From the above, discussions forums face design or structural challenges (Abel et al., 2010; Andresen, 2009; Hammond, 2005). Dunlap et al. (2007) described how instructors perceive tools as not-simple to use and therefore "remain on the shelfs [sic]" and Parker and Parker (2013) go further by citing the lack of awareness of communication tools and "technological characteristics" (Davis, 2014) as impediments to satisfaction. In addition to that, the difficulty of discussion forums in capturing visual cues, the need for some level of information communication proficiency (Hammond, 2005) in using discussion forums and the volume of content are issues that continue to affect the use of discussion forums in higher education. Moreover, existing research seemed to focus on the technologies but not on the discussions forums and features like progress tracking (Sánchez & Hueros, 2010; Wu & Chen, 2017).

Innovation is important to design features that are useful and easy to use to deal with the challenges in the use of discussion forums. A Knowledge Steward and a Knowledge Steward Notification are included in a discussions forum in this research in the hope that discussions forums may become more effective. In doing so, it is important to consider the technology acceptance model that makes it easier to understand the level of acceptability of new technology by users. According to Zhao, Chen & Wang (2016) "the intensity of an individual's intention to use a technology can be explained jointly by their perception about the technology's usefulness and ease of use" (p. 963).

The widespread adoption of online education (Andresen, 2009; Davis, 2014), and the increasing world population make this research into the features important to assure students of the benefits and satisfaction in online education. This research identifies and tests out new features that could engender satisfaction, and motivate users to continue the using of discussion forums as to interact and engage with students in online learning environments.

CONCEPTUAL FRAMEWORK

This section describes a discussion forum as a tool in an LMS with new features that could deal with attrition in online education. In addition, this part discusses the notion that the addition of the Knowledge Steward and Knowledge Steward Notification may influence TAM (i.e. Perceived Usefulness, Perceived Ease of Use), motivation (i.e. Challenge, Interest, Probability of Success and Anxiety) and satisfaction. This part ends with the research question.

Learning Management Systems

The face-to-face classroom may give instant feedback to students, social interaction and a sense of belonging. At the same time, due to its open nature, many students reportedly lack the confidence to engage or ask questions to engender their academic experience. At this point, the online discussion could become a good avenue to engage students and according to Guzdial & Turns (2000) sustain the discussions to meet learning objectives.

Technologies such as Learning Management Systems (LMSs) are helping higher institutions to offer courses remotely and discussions forums help with teacher-student and student-student interactions through social support (Hammond, 2005; Tucker et al., 2014) with peer and teacher feedback. Discussions forums serve some form of supplement (Andresen, 2009) function providing benefits such as no restriction by time and place (Aker, 1997), good collaborative (Persico, Pozzi & Sarti, 2010; Thorpe & Gordon, 2012; Tucker et al., 2014), cooperative, conceptual learning tools (Hammond, 2005), and the opportunity to store exchanges that are retrievable at any time at one's convenience (Abel et al., 2010). There is also the opportunity to engage with a resource person who may not find the time to visit a class (Aker, 2010; Hammond, 2005) and this helps to broaden the participants' experience (Hammond, 2005). Discussions forums have similar features such as the option to post, dashboards, threads of postings and search functions and they exist as peripherals on an LMS.

On the downside, creating curriculum for discussions forums in higher education that enable knowledge building is challenging (Andresen, 2009; Guzdial & Turns, 2000; Hammond, 2005) resulting in the overloading of learners (Hammond, 2005) and the difficulties for instructors to know how to intervene, when to intervene and how to grade activities in the forums. There are also concerns of some participants merely posting for grades or marks and ignoring the quality of contribution (Hammond, 2005). The arguments of the lack of sense of community seem endless in discussions forums and Andresen (2009) captures learners' perceptions better when he stated that "learners felt disconnected from the discussions and were left wondering if the experience were actually real", (p. 254). The storage feature and the thread-like display of discussions forums also mean that participants have to comb through large data meaning that information may not show in the right space on a discussion page (Abel et al., 2010; Hammond, 2005). In addition, the challenges of providing adequate support for instructors and participants (Akers, 1997) are issues that affect the use of discussions forums in higher education.

The majority of the research focused on assessment (Andresen, 2009), online courses (Wu & Chen, 2017), external factors such as motivation and self-efficacy (Sánchez & Hueros, 2010) and merely outlining features and postulating things that could be done (Guzdial & Turns, 2000) to make online education better. This also means that between the face-to-face and online discussions, the latter is failing to live up to the expectations with the arrival of technology and promises that followed.

There have been recommendations for further research to help address some of the challenges above to make discussions forums better. For instance, Aker (1997) suggested in his paper on Web Discussions in Teaching and Learning that developers could focus on building tools that could make the discussions forums more robust. He noticed that although there was a notification feature, it provided reminders on all activities in discussions forums via emails and the course creator sets it up. He suggested adding a personalized notification tool for participants in discussions forums.

To deal with the large data because "keyword-based search" proved ineffective, Abel et al. (2010) tested a Rule-Based Personalization Architecture called a "Recommender System" or "Collaborative Filtering Technique". This was some sort of filter function based on the ratings of

posts by participants in a discussion forum, the frequency of postings and visits to the discussion forum. They suggested that future designs become "user-adjustable" or customizable, easy to use (Abel et al., 2010; Aker, 1997) and make use of clear visual representations (Hammond, 2005). Suffice to say that the "Recommender System" suggestion was referring to software developers.

The differences among the participants in discussions forums (Abel et al., 2010; Akers, 1997) mean that there would be "regularly contributing users, casual contributing users and passive users" (Abel et al., 2010, p. 168). It could be beneficial to make available to participants the contributions of the others who stand out in discussions forums through "follow" to serve as motivation to them.

Common tools of an LMS that may support teaching and learning

LMSs have tools such as discussion forums, upload of videos, audios, document (word, pdf files etc.), chats, emails, dashboards, grading books and with plugins, access to live video options. For this research, the focus is on discussions forums because it is where course content discussions take place.

Discussions Forums

Discussions in education are among the many means of participation in a class and successfully acquiring knowledge online and face-to-face classroom. Andresen (2009) provides further details by asserting that discussion in both the online and face-to-face forms are important to learners' total academic experience. However, while many students attest to the effectiveness of the face-to-face discussion, online education is failing.

There are increasing number of schools offering online courses globally (Andresen, 2009) and new research into discussions forums is important to give online education the chance to thrive and to sustain the continual appeal of online discussions. It is in this regard that the Knowledge Steward used in the theory of Communities of Practice (CoP) and a personalised notification (Aker, 1997), Knowledge Steward Notification, researches are considered as features that could make discussions forums better.

The CoP theory describes a community where individuals with a common goal and "…varying degrees of experience come to learn from one another" (Tucker et al., 2014, p. 107). The Knowledge Steward and Knowledge Steward Notification aim to deal with the issues of too much data and the lack of sequential nature of posts (Andresen, 2009) that obstruct learners from keeping track of information in a discussion forum (Guzdial & Turns, 2000) and offer personalization of notifications in the process.

New Features Introduced in a discussion forum

In the paper of Guzdial & Turns (2000) on computer-mediated anchored discussion forums, they differentiated between "discussion management and facilitation features" that could help with learning in a discussion forum. For the purpose of this paper, the focus is on discussion management features that defines the Knowledge Steward and Knowledge Steward Notification.

Knowledge Steward

One focus of this study would be to create a Knowledge Steward (KS) and have other students follow them as their source of information. Research shows that credibility or reputation and trust associated with the source of information (person), a KS, in this case, can greatly affect the transfer of the information to the one who needs it for knowledge construction (Levin et al., 2004). Tucker et al. (2014) defined knowledge stewards as "communities of practice (CoP) that exist in areas of expertise and are focused on gathering and sharing knowledge with others in the field or outside of it" through "often electronic, such as online message boards and other collaboration tools" means and of the belief that "approaching learning from multiple perspectives can help students expand their

vision of the application of learning to real world working scenarios" (p. 109). KSs are points of connection for those who need the information for use.

For this study, a KS is a person in an online course who other students think of as knowledgeable, experienced and likeable based on their documented background and or expressed interests. Tucker et al. (2014) referred to students so-called more experienced by other students as Knowledge stewards (KS).

Online course participants may follow such persons (by the click of the "follow" or plus icon is shown in Figure 1 below) to get updates on their posts (reactions and opinions) and replies (reflections, references and research) in discussions forums that they could benefit from. This feature would be an icon with an underlying function such as the option to "follow" a person of interest and to receive updates on their posts and replies similar to what is available on the social media site Twitter.com as shown in Appendices A-D.

The "follow" on Twitter is a clickable small rectangular symbol, in the case for this design a plus icon that enables anyone to belong to a circle of people or groups who receive updates on the activities and contributions of persons of interest, thus a selected KS, on Twitter or in a particular course in an LMS. Users who click this plus icon or "follow" button on the KS can have access to the posts and replies of the KSs only via personalized notifications while those who do not select the KSs see all posts and replies from all users in a discussions forum. A "Follow" or plus icon would be embedded into the KS icon feature as shown in Figure 1 below.

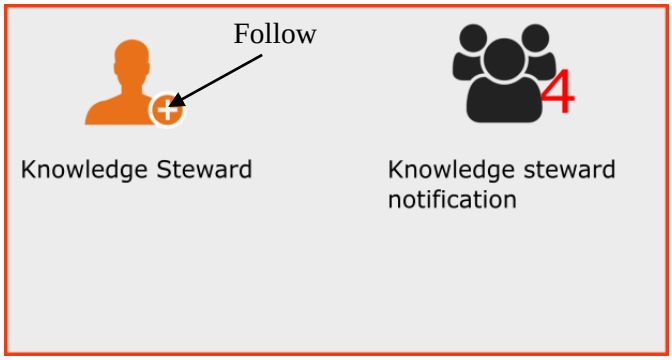

Figure 1. Knowledge Steward with the Follow icon and Knowledge Steward Notification icon with four examples of alerts received.

Knowledge Steward Notification

A notification may be defined as an instant alert that is made available via an application to an individual informing him or her of updates, changes in current events on an application or feature, in this case a KS (Awad & El-Shishy, 2014; Pielot et al., 2014; Wadate et al., 2014). Notifications are important parts of applications and they remind users to engage with the applications (Awad & El-Shishy, 2014; Kim, 2014). The Knowledge Steward Notification would perform the notification functions described with its own display interface.

The Knowledge Steward Notification (KSN) feature displays up-to-date information from all KSs so followers may read their current contributions to a discussion forum resulting in engagement in discussion forums, research and more contributions from other participants. Notifications are good ways to improve engagement and its frequency has an impact on a user's exposure to content (Morrison et al., 2017). Figure 11 shows the main KSN page with the icon on the left top corner and corresponding display on the right side.

The KSN function on reports on information from the KSs and will provide alerts on events linked in the discussions forums. In fact, one importance of these features is to enable sequential posts, feedbacks, and personalised activities as they "hit" the discussions platforms. In addition, they will help keep track of discussions and comments over time and make them available to enable effective participation in discussions forums.

The design of the KSN feature would follow the interface and function known as “Up next” available on the right side of a YouTube video page. The “Up next” on Youtube is a vertical display of available videos based on category, similarity, content or labels in rectangular boxes on the right side of the page. It presents in a rectangular box still photos of available and or searched videos with titles for a user to select. A user may click on any video that then moves to the centre of the page at the central focus of a user. The rationale for using this feature is to help users navigate the discussions forums once the KS feature is enabled, present a better visual display of posts from the KSs in a discussion forum and make available only the information a user requires (based on the selected KS) to socially engage in a course. Figure 1 above shows a KSN feature. Morrison et al (2017) state that users like notifications when they have control over the format and timing and further stressed the need to adopt one type of notification where possible.

Technology Acceptance Model

To measure the perceptions and reactions of people about the capabilities of a technology to work, the study used Perceived Usefulness and Perceived Ease of Use in the Technology Acceptance Model (TAM). TAM “explains the acceptance and usage of information technologies,… the two key factors in determining intention, which predict the development of an innovation and are [sic] present in all studies of TAM model development, are Perceived Usefulness and Perceived Ease of Use,” (Sánchez & Hueros, 2010, p.1633).

Constructs such as Perceived Usefulness and Perceived Ease of Use are key in measuring the users’ behavioural perceptions towards the technology. Knowing the perceptions and behaviours of users are important in gauging their acceptance of KS and KSN features this research seeks to bring to the fore.

Perceived Usefulness

“Perceived Usefulness is considered to be an extrinsic motivation for the user and is defined as the degree to which a person believes that the use of a particular system can enhance work performance” Sánchez & Hueros, 2010, p.1633). The Perceived Usefulness (PU) is present to measure when a technology proves useful for a learning objective or task. In this research, respondents will use the KS and KSN features to perform a task and report on its usefulness through a pre and post measure.

Perceived Ease of Use

“The other determining factor is ease of use, which is the degree to which the individual considers that the usage of a particular technology does not entail extra effort; the greater the perceived complication, the lower the degree. This has a positive influence on Perceived Usefulness” (Sánchez & Hueros, 2010, p.1633). In other words, where technology usage requires less effort to perform a task, the Perceived Ease of Use (PEOU) is likely to be higher for that technology. That in turn leads to a higher likelihood of adoption for use. PU strongly influences PEOU (Wu & Chen, 2017).

Motivation and Satisfaction

Motivation in this research is limited to the work of Vollmeyer & Rheinberg (2006) that outlined four constructs of motivation, thus Challenge, Interest, and Probability of success and Anxiety. The aim of this research is to introduce new features that may spark engagement among participants and make discussions forums more user-friendly ultimately leading to the performance of tasks and learning as expected in online courses.

Vollmeyer & Rheinberg (2006) surmised that challenge emanates from a learner’s assessment of the learning situation as either difficult or easy in their attempt to achieve success. A learner’s conclusions based on the assessments informs their perception of the level of task difficulty.

Regarding the construct of interest, it is good to ensure that the learning material appeals to user because then it would "…have positive affects [sic] and positive evaluations regarding the topic" (Vollmeyer & Rheinberg 2006, p. 241) and the true effects of the KS and KSN could be available for measuring.

The probability of success (POS) is a learner's calculated perception of the self to succeed at task taking into account factors such as the difficulty of the task and their own abilities (Vollmeyer & Rheinberg 2006). However, for the purpose of this research, POS is limited to participant's ability to complete the tasks in the experiment.

According to Vollmeyer & Rheinberg (2006), anxiety "…can be partly interpreted as fear of failure in a specific situation" (p. 241). For this research, anxiety is defined as a respondent's fear of failing at the task in the experiment because of the difficulty of the tools incorporated in the discussion forum or the absence of it.

Research Question

1. What is the impact of KS and KSN on PU, PEOU, motivation and satisfaction in an online forum in an LMS?

There were three experimental conditions. The control condition had a discussion forum without any no other features. The next experimental condition received the KS but no KSN and third condition received both the KS and the KSN features.

The experiment constituted live demos with tasks for the control, KS, and KS and KSN conditions for the first measure. Followed by the same live demo used in the pre measure with the same task for the control condition with another live demo and similar tasks (with minor structural changes as seen in Figures 4 and 15 below) for the KS condition and the KS and KSN to measure the post questions.

The pre and post measure helped to gauge the homogeneity of the representative sample used in the experiment and to measure the behaviours of the respondents from the first exposure to the same discussion forum and tasks to when they experienced the KS and KSN features. The belief is that this method could generate a true influence of the new features if there is a difference in behaviours in favour of a condition.

Out of the research question, these hypotheses were tested:

H0: There will be no difference in the first measure of the PU, PEOU, Motivation and Satisfaction in the control, KS and KS and KSN conditions.

H1: There will be a difference in favour of the KS, and KS and KSN conditions in the second measure of the PU, PEOU, Motivation and Satisfaction when compared to the control condition.

Scientific and Practical Relevance

For the purpose of science, it is believed that the outcome of this research would spur on others to research into identifying some more benefits and perhaps disadvantages in either the long or short term of the features. In addition to that more theories could be developed around these features to create templates for using them, ensuring the reliability of results or outcome independent of geography. Finally, learning theories would consider the integration of these features as prerequisites when designing a suitable and effective online learning environment.

At the end of this research, it is expected outcomes will be relevant for practice. There would be a better understanding into what satisfies the online student, especially regarding the discussion forum. Secondly, there would be an increase in engagement in the online environment as a result of the new features introduced in the discussion forum. The third reason is that these features would give students control to regulate the content that is usually available in the online learning environments. In addition to that, confidence would be engendered in online education particularly in a discussion forum as worthy of supporting teaching and learning. Finally, the attrition linked to the feeling of isolation and lack of motivation would be reduced.

METHOD & DESIGN

This section identifies the participants, the research materials including the tasks, demos and as well as the pre and post measures.

Respondents

There were 60 respondents with ages between 19 and 36 randomly sampled from Engineering, Health Sciences, Social Sciences and Business programmes at the University of Twente. The distribution of male and female was not uniform with one female in the control condition, three in the KS and KSN condition and no female in the KS condition.

The study ignored the experienced level of the respondents in using discussion forums especially as the University of Twente uses Blackboard LMS but the research opted to use Moodle with added features. This research used the University of Twente students as participants considering the time available for this research and convenience.

Materials

Mock-ups

There were three designed and functional mock-up discussions forums adopted from Moodle and used in the experiment for the control, KS, and KS and KSN conditions. These mock-ups were clickable web pages and distinguished by the added features, thus the KS and KSN. The control condition was a generic Moodle discussion forum page with no added features as shown in Figure 1 below while the KS was added to that design to create the image in Figure 4 also below. To get the image in Figure 8 below both the KSN and the KS were included in the design.

All the discussions forums used the same content on Self-introduction based on real life persons. The mock-ups were such that respondents had to select three predetermined participants out of 10 for the experiment. The second discussion topic, Human Development, used content on Nature versus Nurture in Psychology. The content was 27 real posts selected from among many posts by individuals on the same topic in an online course. The research ensured that the mental effort for the tasks was the same for all respondents the tasks.

Control Condition

This condition showed the original layout with posts and replies from a discussion forum. The page below had no new functions or icons like was available on the KS and KSN, and the KS.

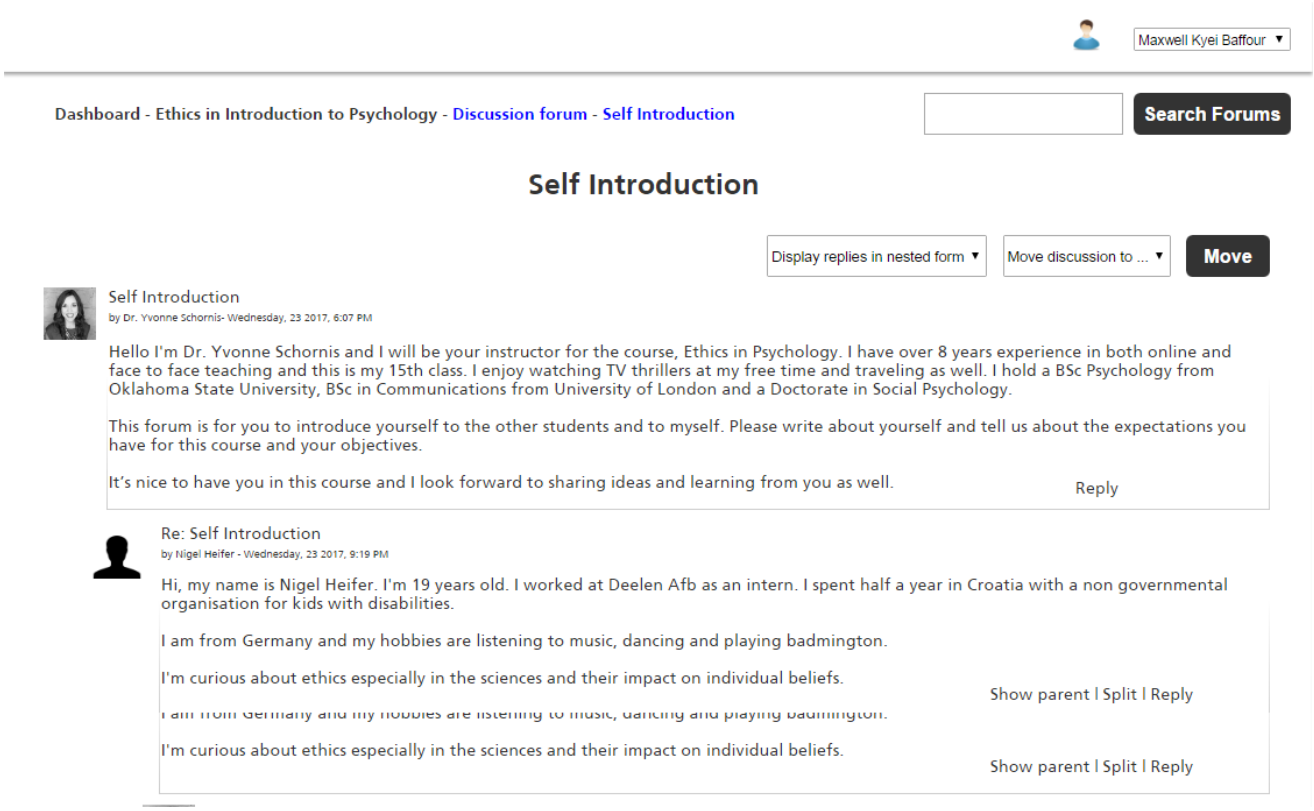

Figure 1. Discussion forum page with posts.

Figure 2 below shows the landing page for all discussion topics with "Replies", the number of the posts and replies to the posts. Here, by clicking on a number under "Replies", an individual would see all posts and replies by all participants in a discussion forum as shown in Figure 3 also below.

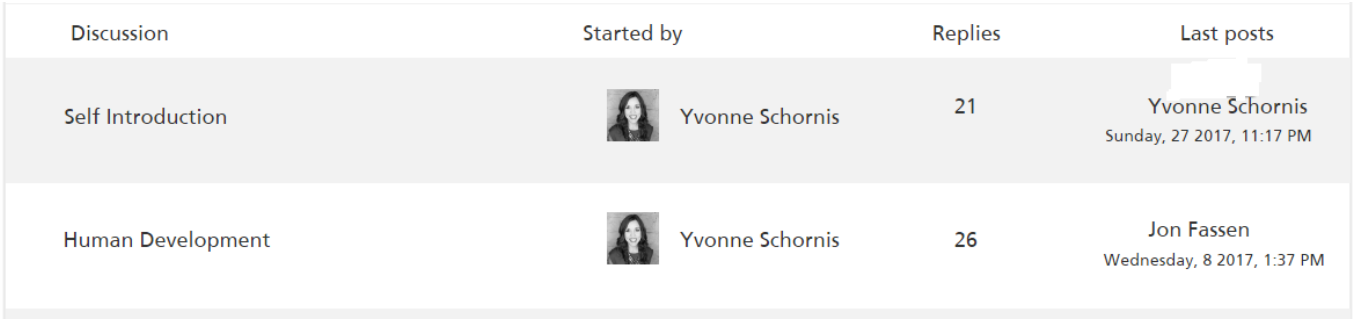

Figure 2. Landing page for all topics and the number of posts in discussion forums in a course.

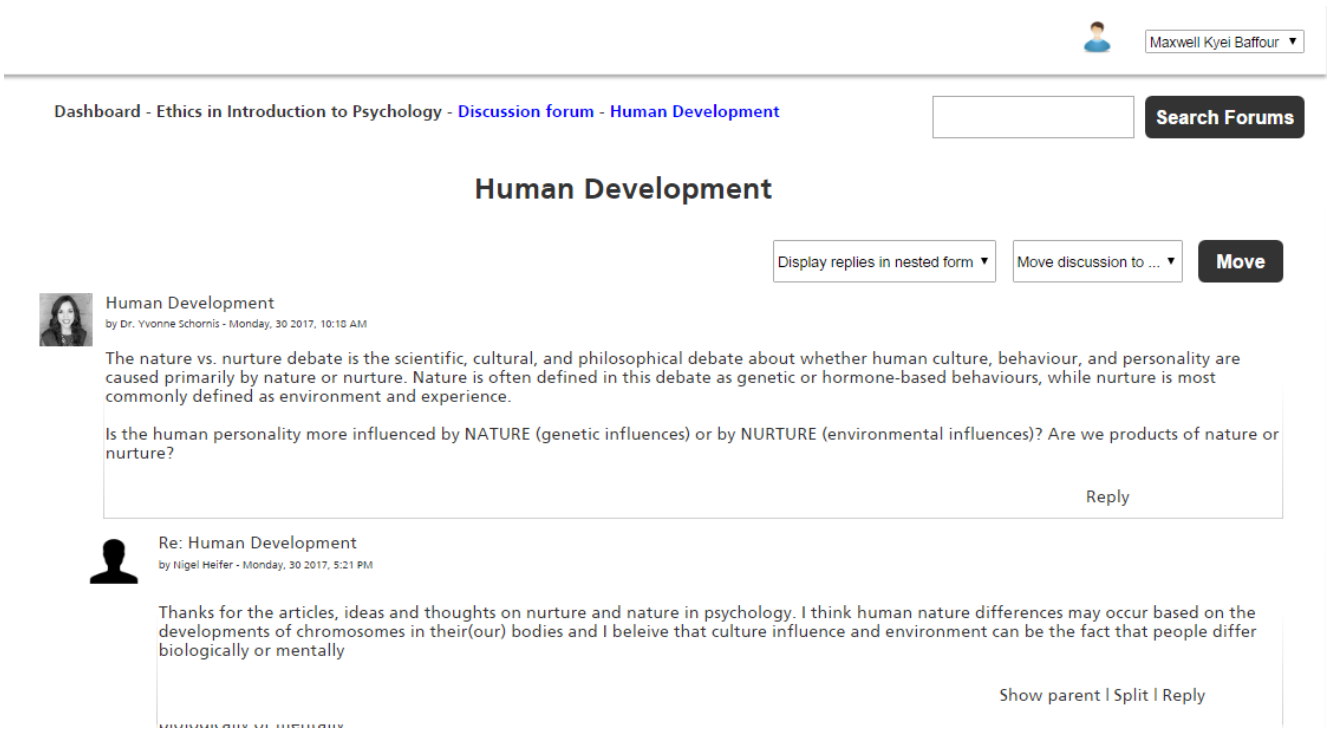

Figure 3. A discussion forum with a post and reply for the control condition.

KS Condition

This condition had a page similar to the KS and KSN condition except for the absence of the icon at the top left corner of the page. It also had the "follow" function embedded into the picture icon as well as shown below.

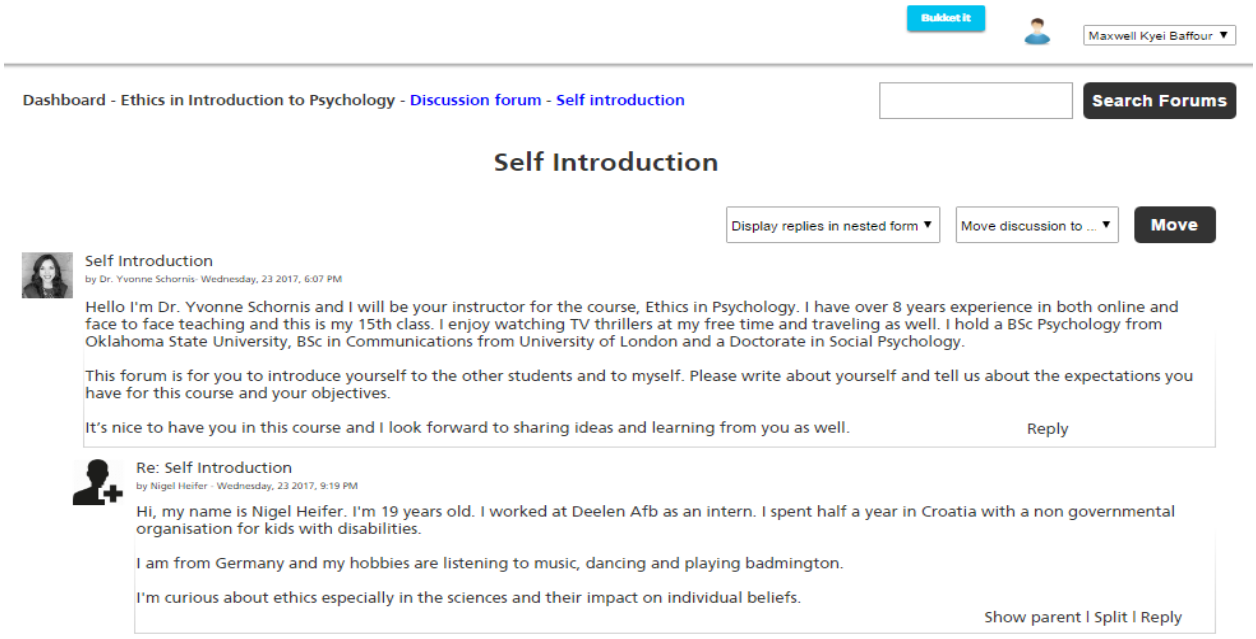

Figure 4. Knowledge steward indicated by the Follow icon (plus).

The plus icon changes to a tick or "correct" symbol as shown below when a KS is selected for the first time. This was also similar to that of the KS and KSN.

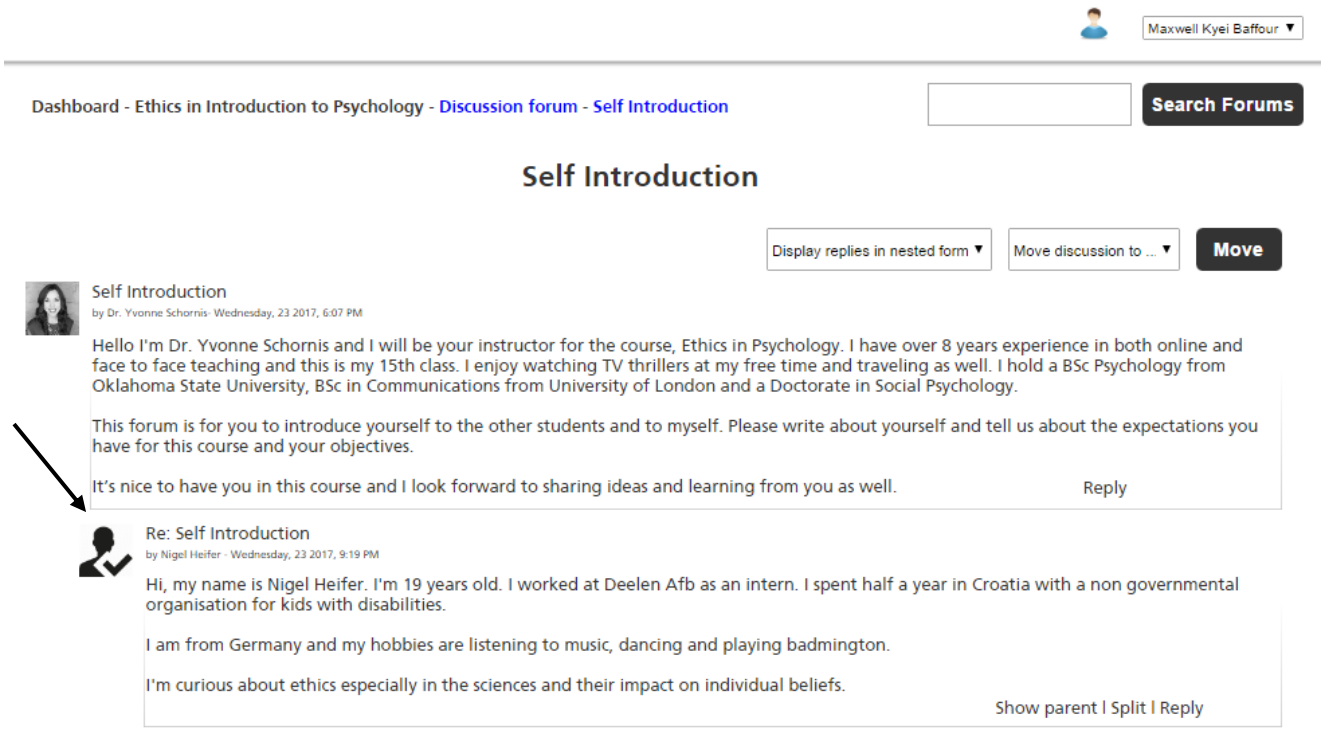

Figure 5. A selected KS indicated by the tick or "correct" symbol.

One is directed to the discussions forums landing page by clicking the discussions forums like at top of the page in Figure 5 above. Here, to see posts from the KSs, one had to click on the numbers available under "Replies" as shown in the screenshot below.

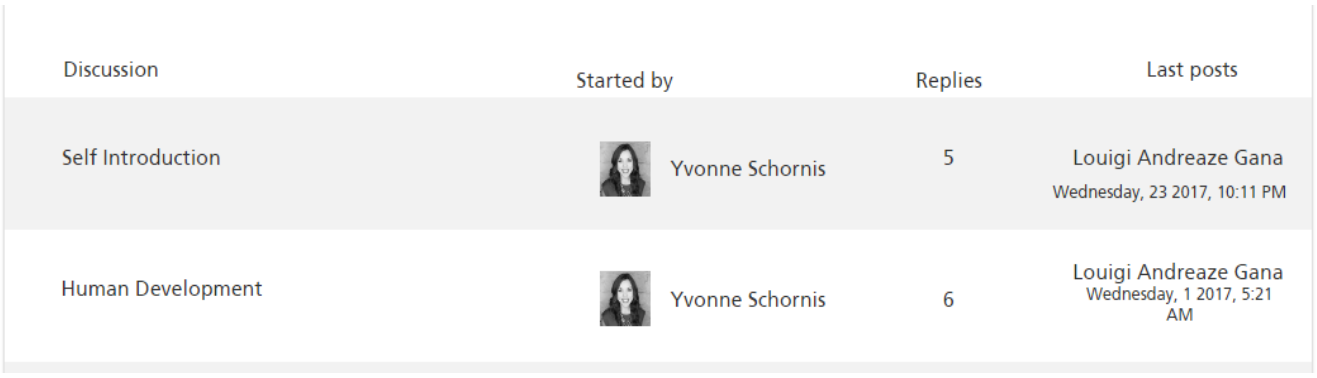

Figure 6. A discussions forums landing page with the number of posts from the KSs and the discussion topics.

Figure 7 below shows the result of clicking a number under “Replies”.

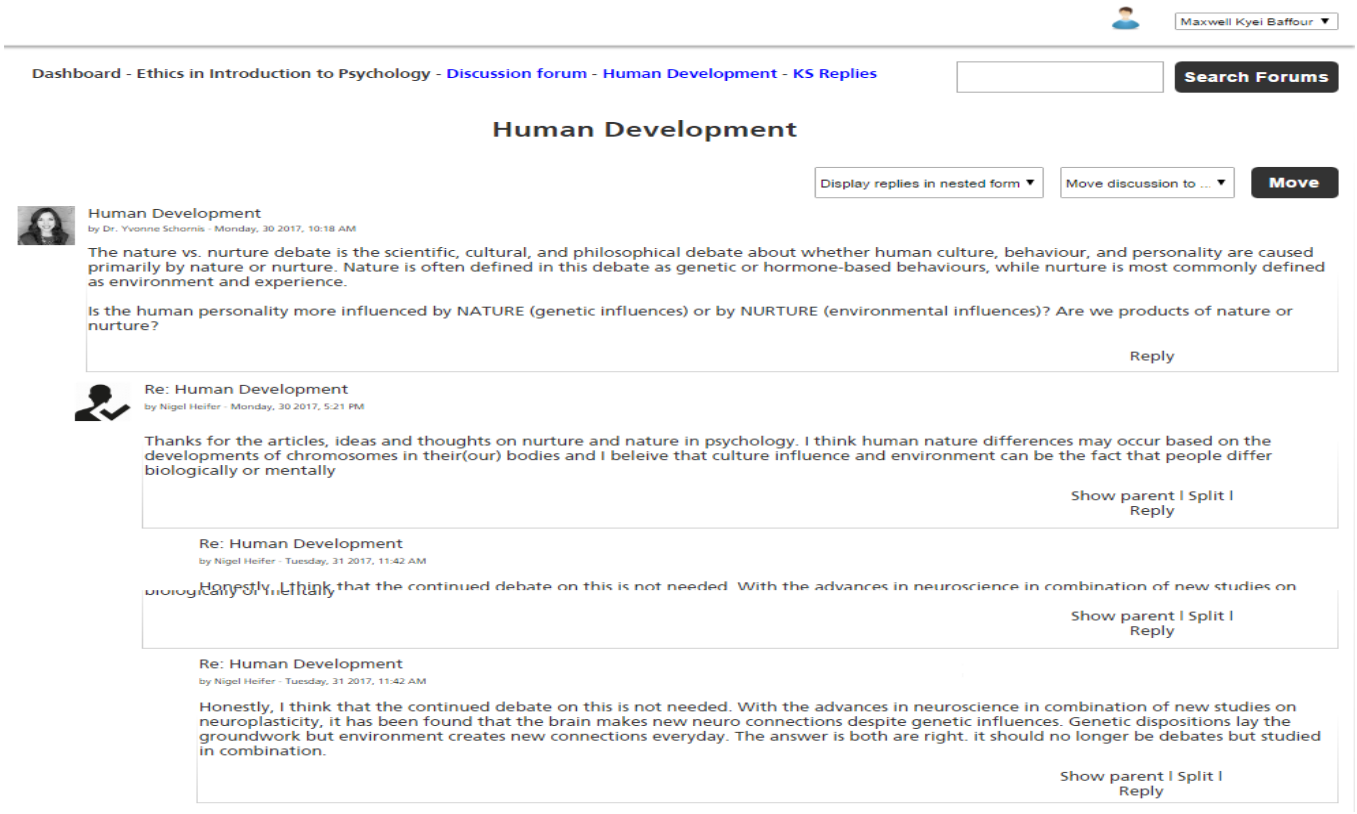

Figure 7. A KS with posts and replies.

Unlike the KS and KSN, this page did not have the “Up next” functionality; rather it displays all posts and replies by the KSs on the same page.

KS and KSN Condition

This condition had a KS that enabled participants to follow others by using a plus icon embedded into the picture icon. This was then combined with a “follow” functionality, that enables anyone (by clicking on it) to be a part of a circle of individuals or groups who are constantly updated on the activities and contributions of persons of interest, used by Twitter and explained under KS above. It also had a KSN (notification) icon at the top left corner of the passage which displays the notifications from the KSs. Below is a screenshot from a live page.

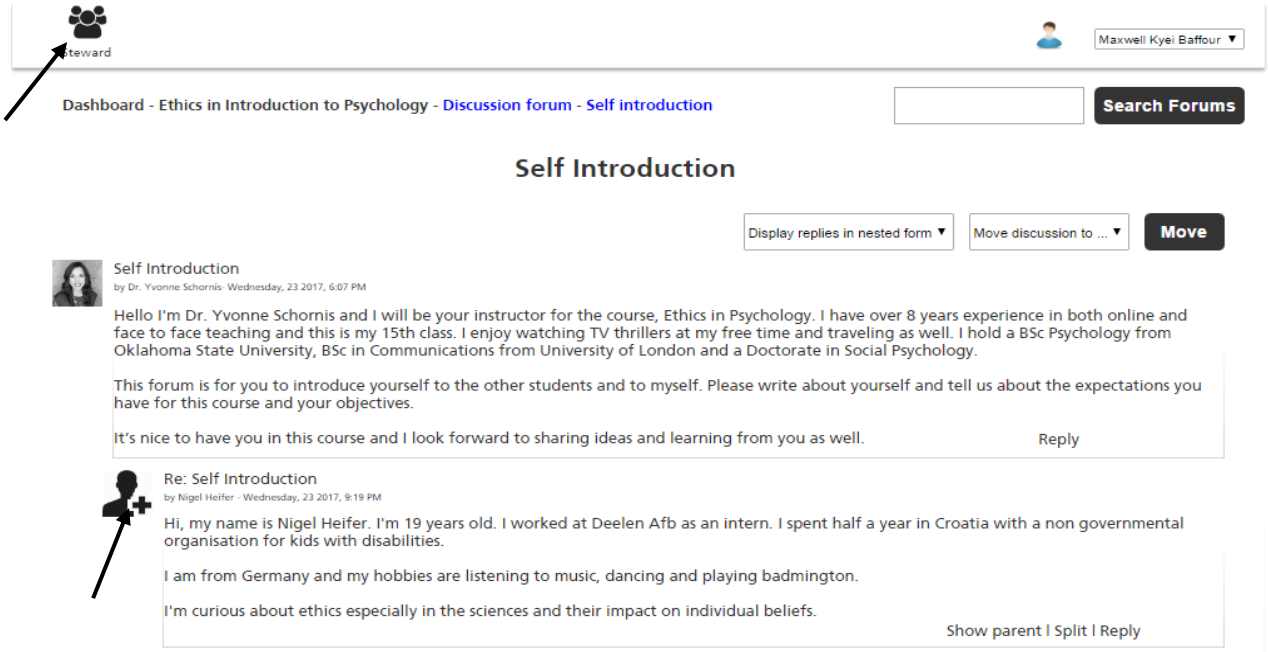

Figure 8. Knowledge steward indicated by the Follow icon (plus) and Knowledge steward notification icon – top left corner.

The condition also showed every activity that involved a KS including displaying either their posts and or when another participant selects a KS. The screenshot below shows a selected KS and the KSN.

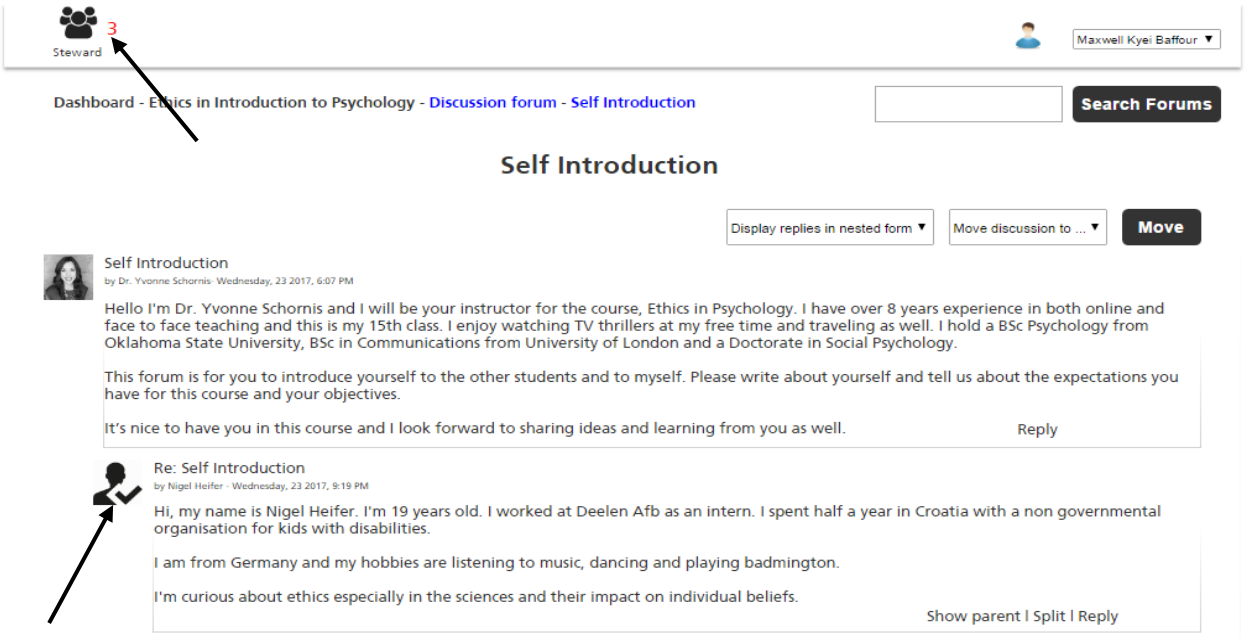

Figure 9. A selected KS indicated by the tick or "correct" symbol and the number of notification items – top left corner.

The KSN page provides an overview of the selected KSs and the different discussion topics as seen below.

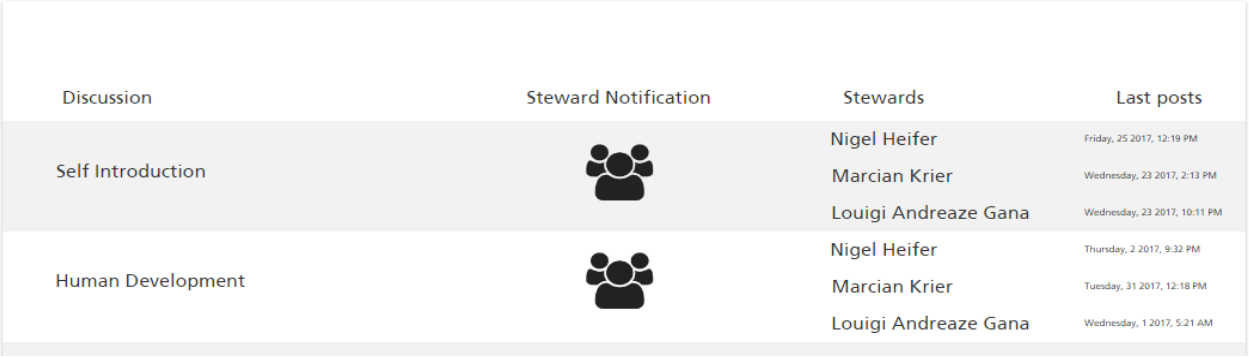

Figure 10. A KSN landing page with the names of the KSs and the different discussion topics.

When on a particular discussion page, clicking the KS icon on the top left corner takes one to the page screenshot below.

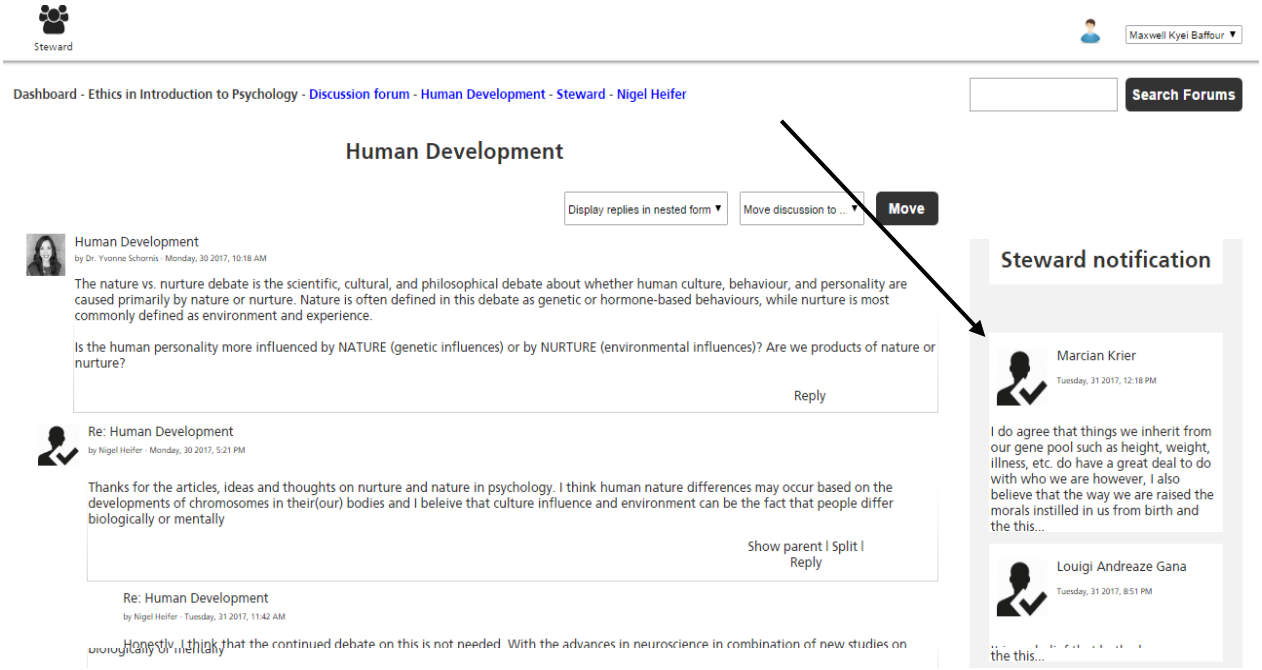

Figure 11. A KS notification page with posts and replies.

The display on the right side of the page in Figure 11 above is a functionality that adopted from the “Up next” feature on YouTube. The “Up next” on Youtube is a vertical display of available videos based on category, similarity, content or labels in rectangular boxes on the right side of the page. It presents in a rectangular box still photos of available and or searched videos with titles for a user to select. Selected videos move to the centre of the page at the central focus of a user. Also applied here, by clicking on the name or icon with previews of posts on the right side, the posts from that participant with replies to other posts move to the centre of the screen.

Tasks

The pre and post measures for the control, KS, and KS and KSN conditions consisted of similar tasks as enumerated below.

Task performed in the first measure

A. **On "**SELF INTRODUCTION**", select the** first 3 participants by writing down their initials.
B. Click on the Discussion forum link **at the top of the page.**
C. **On "**HUMAN DEVELOPMENT**", click on the** number shown under "Replies" to see posts.
D. Search through the discussion forum and write down the last 3 words **in each of all their posts.**

Figure 13. The task for the pre measure in the three experimental conditions.

In the second measure for the control condition, the participants performed the same task in Figure 13 above. The KS, and KS and KSN conditions, on the other hand, performed the slightly similar task as shown in Figure 14 and 15 below respectively.

Task performed in the second measure by the KS condition.

A. **On "**SELF INTRODUCTION**", select the** first 3 participants **by** clicking the plus icon **in their profile picture.**
B. Click on the Discussion forum link **at the top of the page.**
E. **On "**HUMAN DEVELOPMENT**", click on the click on the** number shown under "Replies" to see posts.
C. Search through the discussion forum and write down the last 3 words **in each of all their posts.**

Figure 14. The task for the post measure in the KS condition.

Prior to the task above, the research explained KS function to the respondents in the experimental condition with the same name as outlined in the conceptual framework.

Task performed in the second measure by KS and KSN condition

A. **On "**SELF INTRODUCTION**", select the** first 3 participants **by** clicking the plus icon **in their profile picture.**
B. Click on the Discussion forum link **at the top of the page.**
C. On "HUMAN DEVELOPMENT**", click on the** Steward icon **or** names **to see posts.**
D. Click on names at the right side of the page **and** Write down the last 3 words **in each of all their posts.**

Figure 15. The task for the post measure in the KS and KSN condition.

Before participants performed the task in Figure 15 above, the researcher explained KS and KS functions to them in the experimental condition with the same name as captured in the conceptual framework.

A pilot study with three respondents was conducted. In the study, they watched a screencast of a Moodle discussion forum for one minute and fifty-eight seconds for the pre measure in Appendix L and then performed the tasks in Figures 13, 14 and 15 above for the post measure. From their observations and feedback, they appeared detached from the activity and questioned the reason to answer the pre measure in Appendix L as they merely watched a video. The task in Figure 13 above replaced the video for the pre measure.

Instrument

The instrument for the experiment consisted of pre and post measures. As explained before, the rationale for this format was so the pre measure is used to measure the entry behaviour while the post measure could help gauge any changes that occurred during the experiment. In addition to that, they helped to measure the homogeneity of the sample used in the experiment.

The questions included personal information (parent's initials, age, sex) to enable coding and identification of responses. The second part was a 25-test item measuring the PU, PEOU, motivation (Challenge, Interest, Probability of Success and Anxiety) and satisfaction while the final part was an additional information section. PU items were the first six, followed by PEOU with four items, Motivation (Challenge with two items; Anxiety with two items; Probability of Success with two items; and Interest with three items) summed up to nine items, and the last six included four Satisfaction and two Attitude items. The availability of existing questions on the constructs to be measured determined the differences in the number of items used in the pre and post measures.

The questionnaire for the post measure comprised parent's initials, the test items and additional information section. The questions consisted of a stem and possible options along a list of five points Likert scale from 1-Strongly Disagree to 5-Strongly agree as shown figure below.

Question	strongly disagree	**d**isagree	**neit**her	agree	**strongly agr**ee
I feel satisfied that web-based system offers the best services that can be achieved for me	O	O	O	O	O

Figure 16. Sample question with a Likert scale.

The constructs used in the questions were adopted from other writers and table 1 shows the details.

Table 1. Composition of constructions – pre and post measures.

Composition of constructs for pre and post measures.	
PU	Sánchez and Hueros (2010)
PEOU	Wu and Chen (2017)
Motivation: Challenge (C) Interest (Items were adapted to the task) (I) Probability of success (P) Anxiety (A)	Vollmeyer & Rheinberg (2006)
Satisfaction	Zhao, Chen, and Wang (2016).
Attitude	Sánchez and Hueros (2010)

To measure PEOU on PU, participants had to perform the task in Figure 13 and to rate their experiences based their feelings of satisfaction and the ease or difficulty of navigating the discussion

forum. Successful performance of task was measured as PU while the ease or difficulty of navigation was PEOU.

Motivation (Challenge, Interest, Probability of Success and Anxiety) attempted to gauge the current and perceived future use of the KS and KSN based on the PU and PEOU while Satisfaction focused on the total experience of the participants from the PU, PEOU and Motivation (Challenge, Interest, Probability of Success and Anxiety).

Procedure

Mocked-up live versions of a discussion forum with the KS and KSN features, KS feature and no features were made available to the three experimental conditions. Participants performed the task in Figure 13 starting from the Self-introduction discussion page as shown in Figures 2, 6 and 10. The task was used in both the pre and post question measures.

In the task, participants had to select specific names and posts and track them in a second discussion topic on Nature versus Nurture from Human development in Psychology as shown in Figures 5, 9 and 12. All these occurred for the three conditions in 10 minutes followed by responses to the questionnaires. The following list outlines the activities including the task for each experimental condition,

1. Researcher greeted participants and explained to them the concept of the research and the rationale for the research (some information was made available to the participants at the end of the study – this is to prevent bias in the data collection) in one minute.
2. Researcher requested participants to undertake the first task. The scores from the questionnaires on this task were compared with those from the post measure. All participants in conditions performed the task in Figure 13.
3. Researcher handed out questionnaires to participants fill out in five minutes.
4. In four minutes, the researcher presented a generic Moodle discussion forum to the controlled condition, a mocked-up live discussion forum with the KS and KSN to Condition A and mocked-up live discussion forum with KS to Condition B. Throughout these demonstrations the researcher explained the KS and KSN features to the participants verbally whiles demonstrating the functions on a laptop.
5. Participants performed the task outlined in Figure 13 for 10 minutes on individual laptops after receiving the links to the live mock-ups from the researcher during the experiment.
6. Researcher hands out questionnaires to participants in all the three experimental conditions to fill out in seven minutes.
7. Debriefing – explain the reason for concealing information – in one minute.

The study conducted in the Library, Horst and premises of the Calslaan building at the University of Twente.

DATA ANALYSIS

Using the pre measure, Levene's test proved that the three sets of independent samples for the control, KS, and KS and KSN conditions were homogeneous with an equal variance $F(2,57)=.49$, $p=.62$. It was necessary to establish the equality of variance because the samples were randomly obtained and any effects were expected to be caused by the presence of the independent variables. Based on the outcome, a one-way Analysis of variance (ANOVA) was applied. ANOVA "…examines the influence of different categorical independent variables on one dependent variable" (Molugaram & Rao, 2017, p. 456-457).

The questions were grouped along these constructs: PU, PEOU, Satisfaction – Attitude – and Motivation (Challenge, Interest, Probability of Success and Anxiety). The dependent variables, PU, PEOU, motivation and satisfaction, were isolated and measured across the pre and post questions scores for all participants.

Construct validity and Reliability

Item internal consistency was measured by pre and post measures for the KS and KSN condition using Cronbach's alpha. PU with the values of 0.90 and 0.92 respectively. For PEOU pre and post measures scores showed 0.74 and 0.75 respectively. However, Motivation made up of Challenge showed 0.34 and -.02 for pre and post measures respectively. Also in motivation, Interest generated 0.72 for pre measure and 0.78 for post measure while Probability of Success showed -.78 and 0.07 for pre and post measures respectively and Anxiety showed 0.57 and 0.66 for the pre and post measures respectively. Satisfaction generated for pre and post measures 0.90 and 0.88 respectively.

For the condition with the KS feature, the Cronbach's alpha showed 0.76 and 0.90 for pre and post measures respectively under PU. PEOU pre and post measures showed 0.79 and 0.87 respectively. On motivation, 0.59 and 0.16 for pre and post measures on Challenge, Interest also showed 0.71 for pre measure and 0.69 post measure with Probability of Success generating -1.82 and -1.35 for pre and post measures respectively and 0.64 and 0.57 on Anxiety for pre and post measures respectively. Satisfaction showed 0.81 and 0.89 for pre and post measures respectively.

Cronbach's alpha was again computed for the control condition. Pre and post measures for PU showed 0.88 and 0.91 respectively. PEOU pre and post measures showed 0.72 and 0.85 respectively. Also, motivation showed 0.23 and -.36 for Challenge on the pre and post measures respectively, 0.75 and 0.81 for Interest on the pre and post measures respectively, Probability of Success with -1.07 for pre measures and -1.91 for post measure while Anxiety showed 0.71 and 0.56 for pre and post measures respectively. Satisfaction also showed 0.92 and 0.93 for pre and post measures respectively.

The constructs of PU consisted of six items throughout the three conditions. PEOU was made up of four items throughout the three conditions. Motivation had two items on Challenge, three items on Interest, two items on Probability of Success and two items on Anxiety whiles Satisfaction had six items for the three conditions.

RESULTS

Relationship between Independent and dependent variables

In this section, the results of the pre and post measurements of the different constructs will be presented. The mean scores and standard deviations are given for the three groups.

Motivation

Motivation (Challenge, Interest, Probability of Success and Anxiety) was analysed for the two treatment groups against the control condition. Among participants, there were small increases and decreases in motivations in the three conditions overall.

Challenge

For the pre measure, the Analysis of variance showed there was no statistically significant differences between the independent variables of the KS and KSN, and KS on the dependent variable, Challenge with $F(2,57)=.37$, $p>.05$. For the same independent variables on the post measure, Challenge showed no significant difference with $F(2, 57)= 2.25$, $p>0.5$. The table below shows the raw mean scores.

Table 2. Raw means comparison table for Challenge as a construct on Motivation.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	2.60(.68)	2.58(.55)
KS	20	2.43(.63)	2.20(.57)
KS and KSN	20	2.45(.78)	2.48(.62)

Interest

The pre measure Analysis of variance of KS, KS and KSN on Interest under Motivation was not signification with $F(2, 57)= .28$, $p>0.5$. For the post measure the same independent variables reported $F(2, 57)= .10$, $p>0.5$ with no statistically significant differences. The table below shows the raw mean scores.

Table 3. Raw means comparison table for Interest as a construct on Motivation.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	2.93(.81)	2.95(.74)
KS	20	2.77(.71)	2.88(.63)
KS and KSN	20	2.92(.82)	2.98(.78)

Probability of Success

The Analysis of variance showed the effect of KS, KS and KSN on the Probability of success with $F(2,57)= .60$, $p> .05$ for the pre measure. The analysis of variance for the post measure on the independent variables above showed no significant differences in Probability of success with $F(2, 57)= .20$, $p>.05$. The table below shows the raw mean scores.

Table 4. Raw means comparison for Probability of Success on Motivation.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	2.90(.38)	2.85(.40)
KS	20	2.90(.42)	2.90(.53)
KS and KSN	20	2.78(.44)	2.80(.57)

Anxiety

The pre measure Analysis of variance of KS, and KS and KSN on Anxiety showed no statistically significant difference with $F(2, 57)= .05$, $p>.05$ with the post measure on the same KS, and KS and KSN on Anxiety showing $F(2, 57)= .83$, $p> .05$ with no statistically significant differences as well.

Table 5. Raw means comparison table for Anxiety on Motivation.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	2.05(.76)	2.13(.86)
KS	20	2.10(.79)	1.85(.78)
KS and KSN	20	2.03(.68)	1.85(.69)

Satisfaction

The pre measure Analysis of variance of the KS, and KS and KSN on Satisfaction reported $F(2, 57)= .40$, $p>.05$ showing no statistically significant difference. The post measure analysis of variance did not show any statistically significant difference of the KS, and KS and KSN on Satisfaction with $F(2, 57)= .98$, $p>.05$. The raw scores in the table below were used.

Table 6. Raw means comparison table for satisfaction.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	3.42(.66)	3.53(.66)
KS	20	3.28(.51)	3.76(.60)
KS and KSN	20	3.41(.57)	3.78(.64)

Perceived Usefulness

The Analysis of variance for the pre measure on KS, and KS and KSN on Perceived Usefulness (PU) showed $F(2, 57)= .50$, $p>.05$ and the post measure analysis of variance also showed no statistically significant variance on the same independent variables and PU with $F(2, 57)= 1.94$, $p>.05$. The table below shows the raw mean scores.

Table 7. Raw means comparison table for PU.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	3.43(.68)	3.58(.67)
KS	20	3.27(.51)	3.78(.67)
KS and KSN	20	3.45(.68)	4.02(.75)

Perceived Ease of Use

The Analysis of variance of the KS, and KS and KSN on Perceived Ease of Use for the pre and post measures showed no statistically significant differences with $F(2, 57)= .29$, $p>.05$ and $F(2, 57)= .78$, $p>.05$ respectively.

Table 8. Raw means comparison table for PEOU.

Condition	n	Pre measure	Post measure
		M(SD)	*M*(SD)
Control	20	3.83(.64)	3.78(.69)
KS	20	3.87(.70)	4.05(.75)
KS and KSN	20	3.98(.59)	3.96(.62)

DISCUSSION

In this study, the TAM was important to find out if the KS and KSN features were worth exploring further. TAM made it possible to gauge the acceptability and usefulness of the new features. The research proposed two new features, the KS and KSN that could reduce attrition, provide personalized notifications, and lead to social and content awareness while increasing motivation and satisfaction.

Feelings of isolation, reducing motivation and increasing attrition (Boton & Gregory, 2015) have directed attention to online education especially discussions forums where interactions take place (Akers, 1997). Moreover, these interactions are imperative to the total learning process in online education (Hammond, 2005). The expectation was that the KS and KSN was could make discussion forums better.

Overall, the study confirmed the first hypothesis that there is no differences on Motivation (Challenge, Interest, Probability of Success and Anxiety), Satisfaction, PU and PEOU among the control, KS, and KS and KSN conditions. A discussion forum should be easy to use (Abel et al., 2010; Aker, 1997) and obviously fit for its designed function. The study missed the second hypothesis that a difference in favour of the KS, and KS and KSN conditions on PU, PEOU, Motivation and Satisfaction would take place.

Although the results did not show any improvements in using the KS and KSN, its usefulness, ease of use, the effect on motivation could be in the long-term. The KS feature represents the celebrities, professionals or favourite persons one follows on Twitter or Facebook to know more about while the KSN is the personalized notifications from these specific people.

These KSs are embedded on Twitter and Facebook and give users some form of social access to others. Considering the lack of information among students (Kear et al., 2014) and teachers (Boton & Gregory, 2015; Gütl et al., 2014) and feelings of isolation leading to reduced completion rates in online education (Gütl et al., 2014), the KS and KSN tools could be an option to pursue. Whiles the KS, "follow" function is an option on Facebook, on Twitter it is part of the prerequisites to get started. Having both the KS and KSN for course facilitators to use based on their preferences (optional or not) could go a long way to improve activities on the discussions forums.

The KSN performs a similar display function to the "Up next" feature on Youtube which lines up similar, popular or favourite videos to the right side in rectangular frames. This made it easy for a user access. In the case of the discussion forums, it provides the picture and previews of comments posted by KSs for ease of use and quick access. In a different context with smart phones usage, Pielot et al. (2014) noted how users liked the awareness on content that the notifications created. According to Kim et al. (2016) and Morrison et al. (2017), these notifications deliver messages on the go, increase engagement within applications and trigger frequency of visits to content. These KS and KSN (i.e. follow and What's next respectively) features are popular and make it important to conduct further research especially in higher education.

The study took place among a group of respondents who could be assumed as used to the brick and mortar classroom environment and as a result, have less appreciation for what these features represent. Individually, the KS, and KS and KSN features generated comments such as "…really convenient addition", "…useful when the no [number] of hits of a single person is large," "…more practical" when compared to the condition without them. Some did not see any difference between the

KS and the control condition especially. It would be interesting to measure the perceptions of online students on the KS and KSN.

Limitations

The research was extensive and designed to induce objective outcome for a true assessment of variables but it encountered some limitations.

First, the researcher had to approach participants individually and in groups to seek their consent to take part in the study. Taking into consideration the different times of day and the unexpected nature of the approach, some participants may have rushed responses to the questions or not a true reflection of what could be. Some participants quit the experiment in the middle of it because the time allotted for one condition was more than expected. These challenges prompted some changes such as foregoing the need to use video as a form of assessment for the pre question and resulted in the use of two sets of same tasks that some participants found boring during the experiment. While three participants used the video experiment for the pilot study, 60 used the new changes for the rest of the experiment.

Secondly, one of the ideas for the KS and KSN features was to make discussion posts available to users as they trickle in meaning that the content would add to the usefulness and motivation of the users. Unfortunately, the content used in the experiment was from a Psychology course that meant that participants did not read the content. Some did not find the new features useful leading to a reduced motivation and satisfaction level because of the lack of appreciation of the content for which the features were to search and make available to them. In other words, the experiment did not measure the quality of the output of the tasks because there was no link to their programmes of study and the participants perceived the tasks as not meaningful and simple. Future research could customize course content for a specific group of participants and measure the effects of the features over time as well as the quality of work.

The third reason is that the experiment tested out new features in a discussion forum. Generally, discussion forums are part of a fully functional system like Moodle. Unfortunately, the researchers could not design the new features as part of a fully functional and live system, meaning there were problems with navigation especially when a participant mistakenly clicks a button, or does not follow the laid down instructions.

Finally, new technology adoption takes time and based on feedback, changes so others eventually may decide to use it or not. This experiment used a feature that was new to all users but part of Moodle which was relatively familiar to the participants. The majority of the students use Blackboard and it is important to state that this research used Moodle in the hope that results from the measures would be accurate for all users. However, measurements of the dependent variables especially for PEOU, motivation and satisfaction suffered greatly. Future research could design the functions as part of a real course on a live Moodle platform or blackboard and tested over time. In addition, new technologies have simple “how to” guidelines or navigation assistance for new or other users but they could not be done for this experiment which also affected the PEOU and PU greatly.

To summarize, the impact of new features on a discussion forum could be beneficial in reducing attrition, increasing social contact, and engagement and improving motivation to make sure students feel confident to pursue and complete online studies. The outcome of the research means that the KS and KSN features are worth exploring further. However, it would need a better design with tips, how-to, course-relevant content and long-term measures to gauge its impact. The KS feature could be useful in both short and long term, as users get familiar with it. Accurately assessing the usefulness and ease of use of the KSN however, requires more time. If the KS and KSN are integrated into an existing discussion forum in a real course where there are participants and relevant content, its outcome could change discussion forums for the better.

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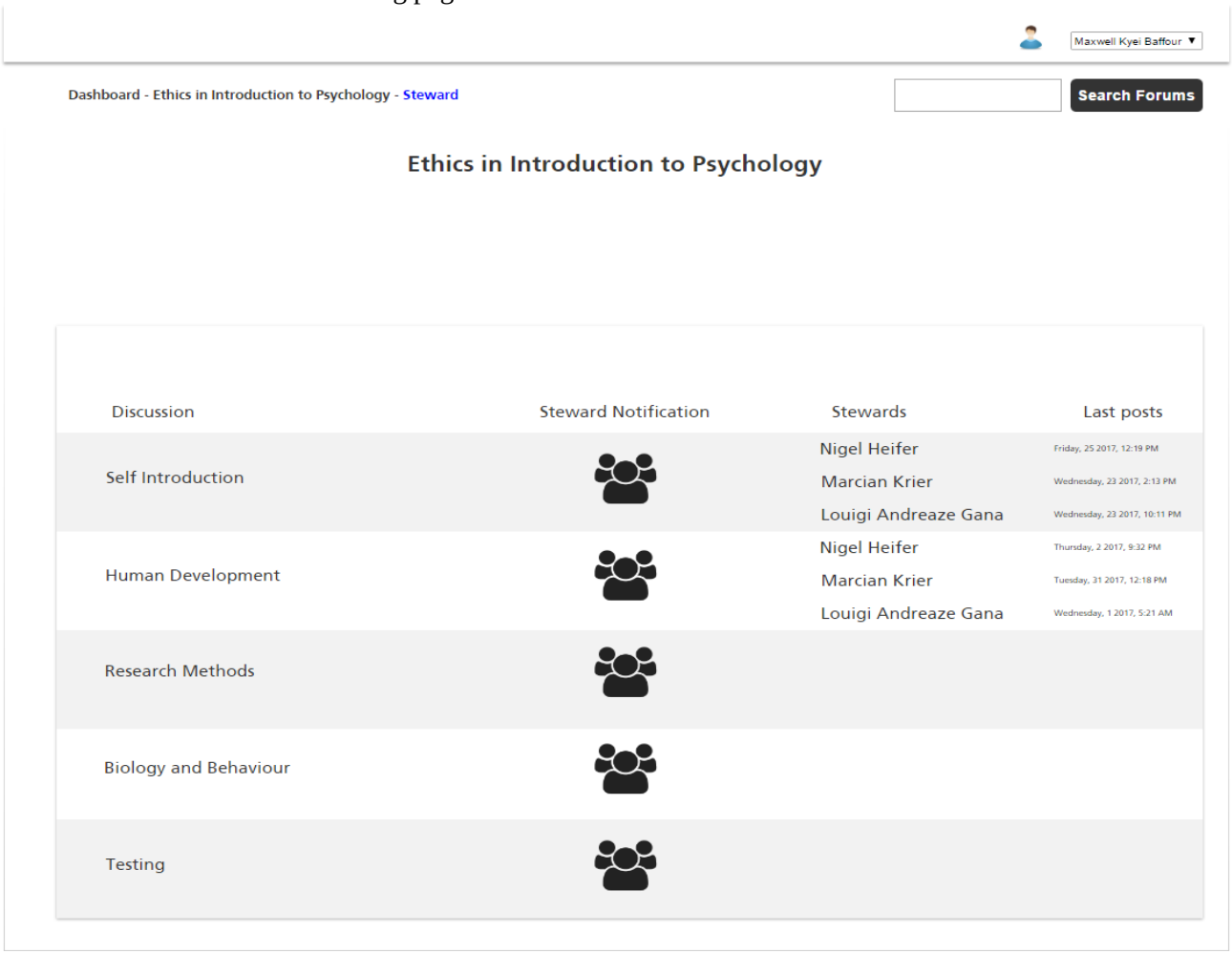
APPENDICES

Appendix A

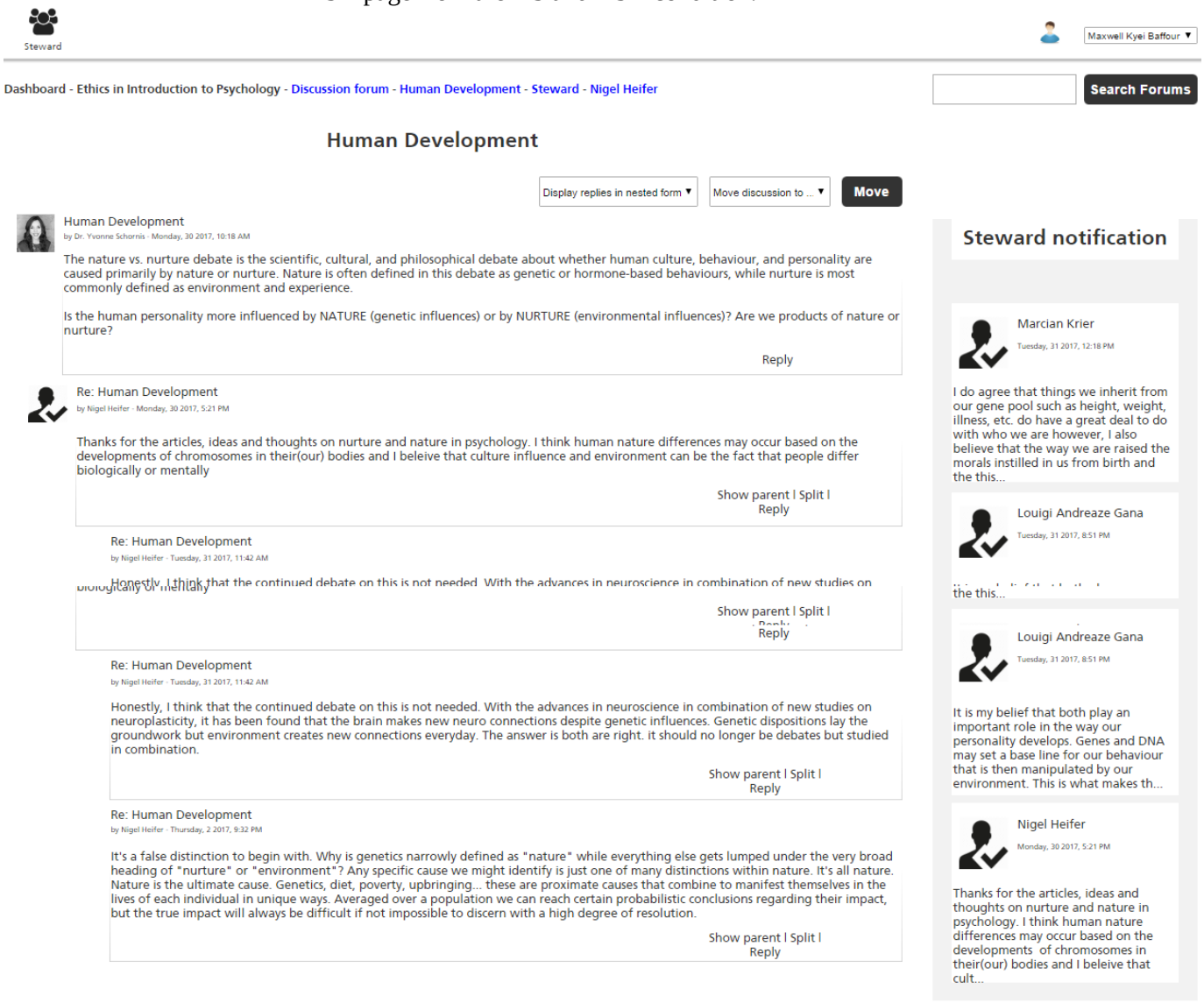
Self-introduction page from the KS and KSN condition.

Appendix B
Self-introduction after KS selection in the KS and KSN condition.

Appendix C
KSN landing page from the KS and KSN condition.



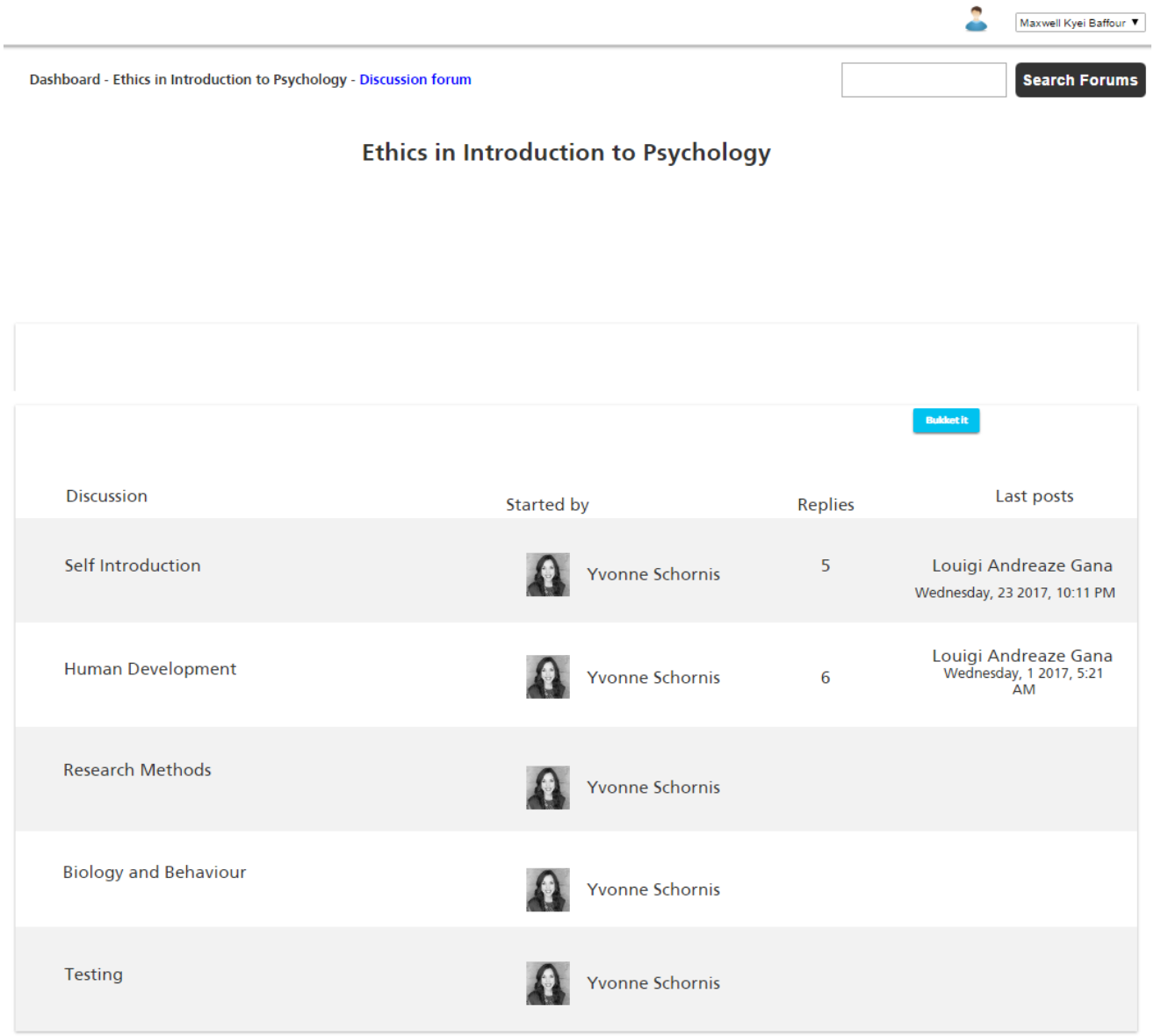
Appendix D
KSN page from the KS and KSN condition.



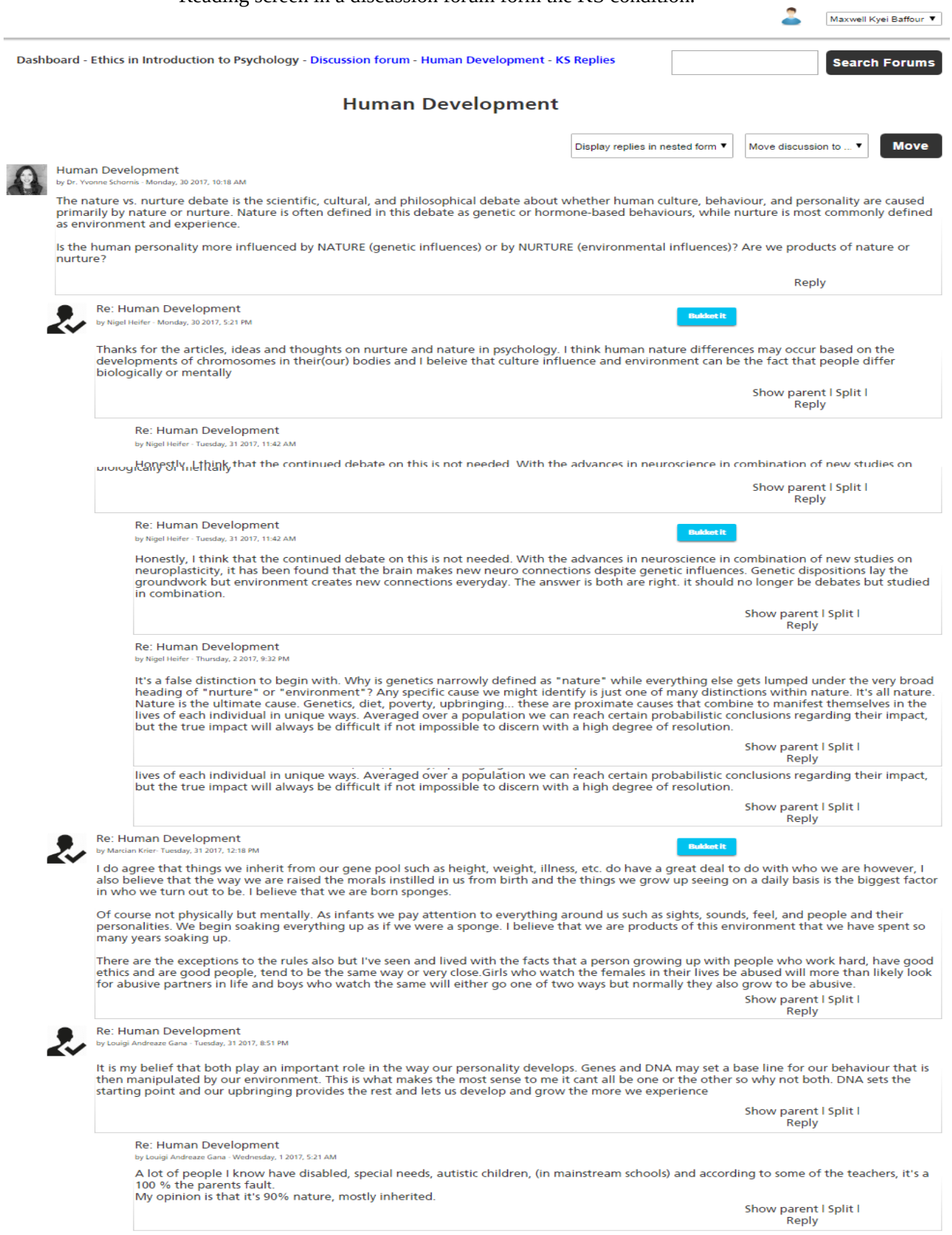
Appendix E
Self-introduction page from the KS condition.

Appendix F
Self-introduction page after KS selection in the KS condition.

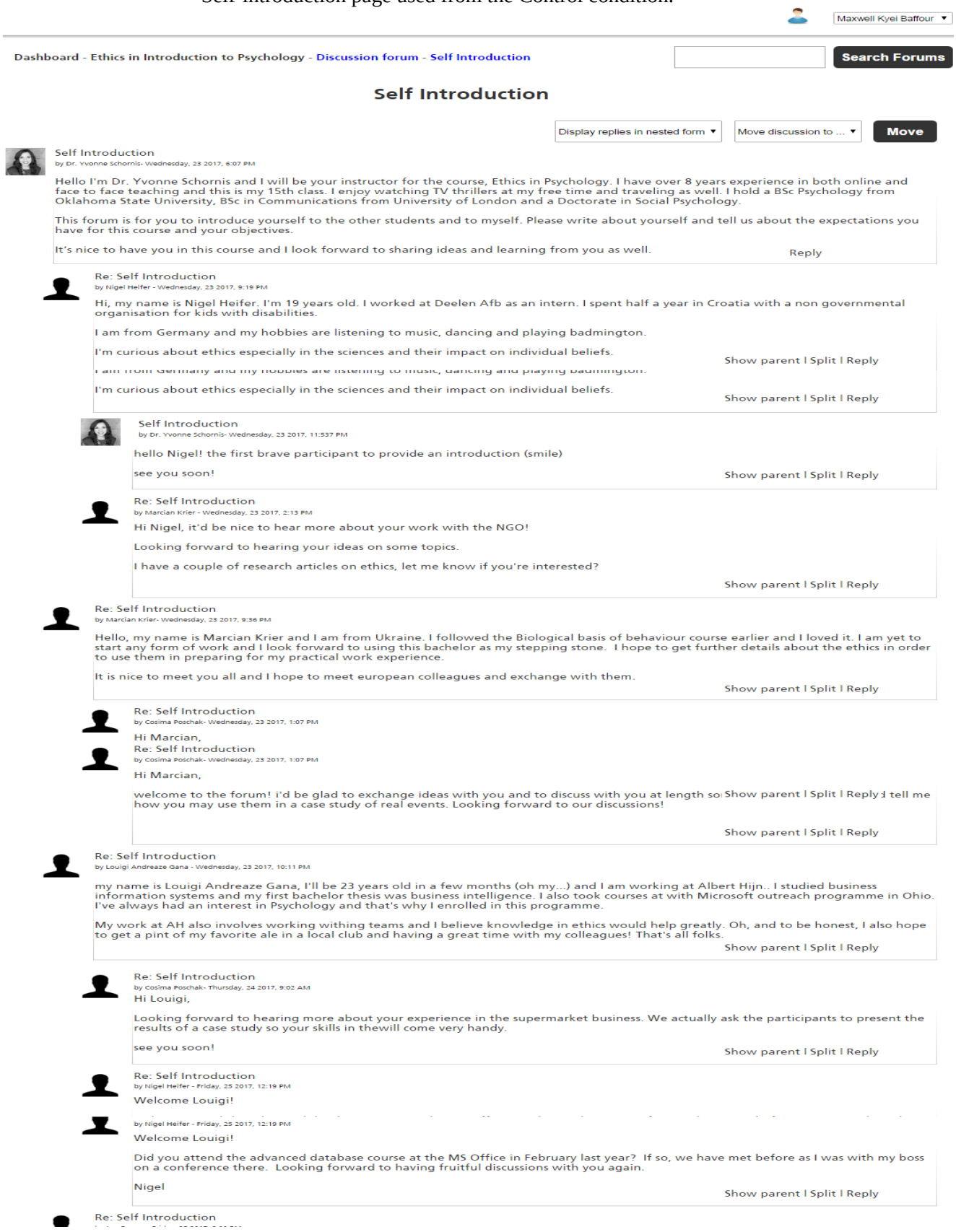
Appendix G
Discussion board landing page from the KS condition.



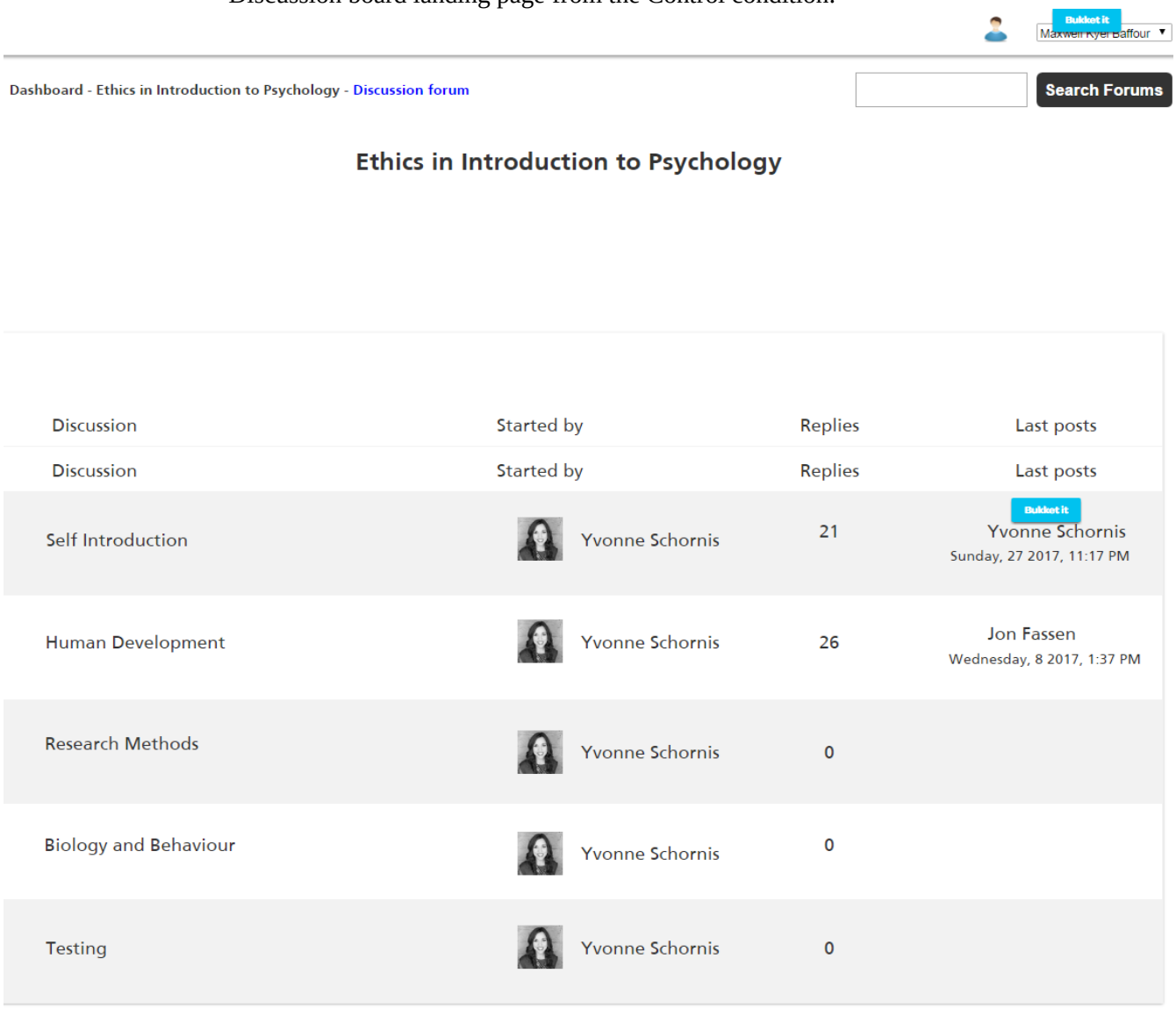
Appendix H
Reading screen in a discussion forum form the KS condition.



Appendix I
Self-introduction page used from the Control condition.



Appendix J
Discussion board landing page from the Control condition.



Appendix K
Reading screen from the Control condition.

Appendix L

Pre-test

Initials of parents are important to identify your responses on the pre and post questions and also to ensure your anonymity of your responses and identity.

Initials (Mother/Father)
_____(*Required)

Age_____ Gender_____ Approximate number of college credits completed_____

Online Experience:
___I have used discussion forums for personal tasks.
___I have used discussion forums for University of Twente course tasks.

Please select the most appropriate category that matches your response.

Question	strongly disagree	disagree	neither	agree	strongly agree
The Web-based system helps me to do the task more efficiently	O	O	O	O	O
The Web-based system improves my task performance	O	O	O	O	O
The Web-based system makes my task performance more effective	O	O	O	O	O
The Web-based system makes it easier to do the task	O	O	O	O	O
The Web-based system gives me more control over my tasks	O	O	O	O	O
Overall, the Web-based system is advantageous for my tasks	O	O	O	O	O
Learning to use the Web-based system is easy for me	O	O	O	O	O
It is easy to get posts from the Web-based system	O	O	O	O	O
The process of using the Web-based system is clear and understandable	O	O	O	O	O
Overall, I believe that the Web-based system is easy to use	O	O	O	O	O
This task is a real challenge for me	O	O	O	O	O
I'm really going to try as hard as I can on this task	O	O	O	O	O
While doing this task I will enjoy playing the role of a scientist who is discovering relationships between things	O	O	O	O	O
After having read the instruction, the task seems to be very interesting to me	O	O	O	O	O
For tasks like this, I don't need a reward, they are lots of fun anyhow	O	O	O	O	O
I think I am up to the difficulty of this task	O	O	O	O	O
I probably won't manage to do this task	O	O	O	O	O

Question	strongly disagree	disagree	neither	agree	strongly agree
I feel under pressure to do this task well	O	O	O	O	O
I feel petrified by the demands of this task	O	O	O	O	O
My feelings towards the web-based system are very positive	O	O	O	O	O
I feel good about the options of this web-based system for the tasks I work on	O	O	O	O	O
I feel satisfied that web-based system offers the best services that can be achieved for me	O	O	O	O	O
Overall, I am satisfied with web-based system and the services they provide	O	O	O	O	O
Using the Web-based system is a good idea	O	O	O	O	O
Overall, I like using the Web-based system	O	O	O	O	O
Additional information, comments, or questions:					

Appendix M

Post-test

Initials of parents are important to identify your responses on the pre and post questions and also to ensure your anonymity of your responses and identity.

Initials (Mother/Father)
_____(*Required)

Please select the most appropriate category that matches your response.

Question	strongly disagree	disagree	neither	agree	strongly agree
The Web-based system helps me to do the task more efficiently	O	O	O	O	O
The Web-based system improves my task performance	O	O	O	O	O
The Web-based system makes my task performance more effective	O	O	O	O	O
The Web-based system makes it easier to do the task	O	O	O	O	O
The Web-based system gives me more control over my tasks	O	O	O	O	O
Overall, the Web-based system is advantageous for my tasks	O	O	O	O	O
Learning to use the Web-based system is easy for me	O	O	O	O	O
It is easy to get posts from the Web-based system	O	O	O	O	O
The process of using the Web-based system is clear and understandable	O	O	O	O	O
Overall, I believe that the Web-based system is easy to use	O	O	O	O	O
This task is a real challenge for me	O	O	O	O	O
I'm really going to try as hard as I can on this task	O	O	O	O	O
While doing this task I will enjoy playing the role of a scientist who is discovering relationships between things	O	O	O	O	O
After having read the instruction, the task seems to be very interesting to me	O	O	O	O	O
For tasks like this, I don't need a reward, they are lots of fun anyhow	O	O	O	O	O
I think I am up to the difficulty of this task	O	O	O	O	O
I probably won't manage to do this task	O	O	O	O	O
I feel under pressure to do this task well	O	O	O	O	O
I feel petrified by the demands of this task	O	O	O	O	O
My feelings towards the web-based system are very positive	O	O	O	O	O
I feel good about the options of this web-based system for the tasks I work on	O	O	O	O	O

Question	strongly disagree	disagree	neither	agree	strongly agree
I feel satisfied that web-based system offers the best services that can be achieved for me	O	O	O	O	O
Overall, I am satisfied with web-based system and the services they provide	O	O	O	O	O
Using the Web-based system is a good idea	O	O	O	O	O
Overall, I like using the Web-based system	O	O	O	O	O
Additional information, comments, or questions:					