



&RPSXWHU 6FLHQFH
)LQDO \$VVHVVPHQW 5HSRUW
 ,PSOHPHQWDWLRQ 3ODQ
 6HSWHPEHU

)DFXOW\ \$II 8QLYHUVLW\)DFXOW\ RI 6FLHQFH
'HJUHHV 2IIH'	06F 3K'
'DWH RI /DVW	
\$SSURYHG)L	\$UWLILFLDO ,QW&RPSXWHU%DVHG *DPHV *UDSKLFV ,PDJH 3URFHVVVLQJ DQG &RPSXWH 'LVWULEXWHG 6\VVWHPV 6RIWZDUH (QJLQHHLQ&RPSXWHXP,DWHUDFWL 7KHRUHWLFDQ &RPSXWHU 6FLHQFH &RPSXWHU \$OJHEUD %LRLQIRUPDWLFV DQG %LRFRPSXWLQJ
([WHUQDO 5H	'U 0DULR 1DVFLP&RPSXWHPPDG =XONHUQLQH)DFXOW\ RI 6FLHQ 5FKRRO RI &RPSXWLQJ 8QLYHUVLW\ RI \$O&RPSXWHV 8QLYHUVLW\
,QWHUQDO 5H	'U /DXUD 0XUUD\ 1DWDVKD .QLHU \$VVRFLDWLW 'HDQ *UDGXDWLW -XQH)DFXOW\ RI +HDOWK 6FLHQFHV

'DWH 3URJUDP)DF 5HVSQRVH 5H	3URJUDP -XO\ 'HDQ -XO\ -XQH
(YDOXDWLRQ	*RRG 4XDOLWZRULW KX5H 6HSWHPEHU
\$SSURYDO 'D	6835 * 2FWREHU \$&\$ 2FWREHU 6HQDWH 1RYHPEHU
<HDU RI 1H[W	<HDU RI QH[W F\FOLFDO UHYLHZ
'DWH RI 3URJ 5HSRUW	-XQH

2YHUYLHZ RI :HVWFHUCQ\$MY&LHFD\$VVHVVP HQWHVMSRUWLQJ 3UF

,Q DFFRUGDQFH ZLWLKW:HWLWPHUCQJ V X, QORVH V\$W V, X\$B QFMK3HU) L C
\$VVHVVP HQW 5HSRUW)\$5 SURYLGHV HZV X QVHU QD OWK H VSV
DQG DVVHVVP HQW DQV KHY & DFX\$XWLHQ 6RFL3URFJU D B DGHXOLVHH U
E\ WKH)DFXOW\ RI 6FLHQFH

7KLV)\$5 FRQVLGHUV WKH IROORZLQJ GRFXPHQWV
WKH SURJUDP V VHOI VWXG\ EULHI
WKH H[WHUQDO UHYLHZHUV UHSRUW

7KH JUDGXDWH VWXGHQW FLHQ & RPUXQBQFDHQXDO FRQ
VWXGHQW SUHVHQWDWLRQV WKH 8QLFKHQ L&RPSIXWHWV
6FLHQFH FRQIHUHQFH 8:25&6HQ7FHWV LWK \HDU

&RQFHUQV DQG \$UHDV RI, GHSURYLHPIHQD QGK'HL VFXR/JUDP E\ W

7KHUH LV D QHHGYHRCV PVMHLPV UFR OODERUDWLRQ VSD
7KHUH LV LQWHCEHWZRPISXVQLWLRUVRMLVHWLIRU WKR VH C
XQGHUJUDGXDWHFRQPSXWMLXGHQWV VHHUHQGXDWRI VWHYGH

5HYLHZ 3URFHVV

\$V SDUW RI WKH HMKHUQBOLWZYERIZP LWWZIRHH [FRPUSODOLQHYL
RQH LQWHUQDO UDQXZHUVDXGGDQW UHLYGHGZ ZUW ZHURD XPR
,, RI WKH VHOI VWXG\ EULHI LQ DG YDQFKRQ VPKHW VFLHQGXDO
WR SDQGHPLF UHVVWIZRWGRQVZIRWK WKH

9LFH 3URYRVW RI WGXDWKRRRFRUDQRFWXGLHV
\$VVRFLDWH 9LFH3URJUDP RI *WDGXDOWHWXGVMGRFWR
\$VVRFLDWH 9LFH 3URJUDPQLQSDGRDLF\ DQG)DFXOW\
'HDQ RI WKH)DFXOW\ RI 6FLHQFH
\$VVRFLDWH 'HDQ 3URJUDPFRWRDQD 6WXGLHV
'HSDUWPHQW &KDLU
*UDGXDWH 3URJUDP &KDLU
*UDGXDWH ([HFXWLYH &RPPLWWHH
\$VVRFLDWH 8QLYHUVLV\ /LEUDULDQ
*UDGXDWH 3URJUDPQHW 6WDII
3URJUDP)DFXOW\ OHPEHUV
*UDGXDWH 6WXGHQWV

)ROORZLQJ WKH YWKNXDQVUQDHOYUWHIGHZHFURPSXERKHWVLYH
RI WKHLU ILQGLQJV ZKLFK ZDV VHQW HWYRHZKDHQBUJHVSRQ
)RUPDWLYH GRFXPHQWV LQFOXGLQJ GROWKIHV([WHQGD,OR\$H
DQG WKH 3URJUDP DQG 'HFDQDO UHVSRQV\$VVRVFPMIQHW ESDM
)\$5 RI WKH &RPSXWDGXDFLHHQURJ*WDP 7KWH)\$DQGFRQELW
WR WKH 6*36 DQG WR 6835 * E\ WKH ,QVSRWQDQI5WKHYZIHLF
\$FDGHPLF 4XDOLW\ DQG (QKDQFHPHQW

6XPPDWLYH \$VVHVVPHQW ± ([WHUQDO 5HYLHZHUV¶ 5HSRUW
([WHUQDO UHYLHZHUV VKDUHG WKDW ³

6XPPDU\ RI WKH 5HYLHZBQGDWLRQV 3URJUDSRQVFXOW\ 5

7KH IROORZLQJ DUH WKH PHQGDWLRQV WGWKH WKH HUVHUQDO UHYLHZHUV

5HYLHZHUV 5HFRPPHQGDWLRQ
5HFRPPHQGDWLRQV UHTXLULQJ

XQG HUUHSUHVH QWKHGDJUR DBOV SSFDL BDFE VW B LDY W W V H DSSOLF DQWV DQG LQW H
EHIRUH DSSOLF DWLYRQLG DEULB W H Q G WWRD B/Q Q J WKH TXHV
\$ PRUH ZHOFRPLQJ DYLGUR QP E QWL ZHOH B B B O P H O W W K Y H O R S V FROODERUDWL
GLYHUVH KL B HV D Q W X B B S X W U Q Q D F R B R V L W L W D R Q Q W U R G X F H V D F R P P R Q 0 6 F F
FROOHDJXH LQW HUD V W D R Q Q W J K U R F X J K B U W W Q H H V X U H W V W L R Q V E H O R Z

([WHUQDOO\ IXQGH B SRJMLDWR QVSDUWPHQW IL D G L Q L Q X S S R V U H D U F K I Z D S D X Q W \ B R G L Q L R Q V D Q G Z L O
DGYRFDWH IRU QHZ SRVLWLRQV HVSHISIDDJOPH QHW Z D O E K S R B V X W L R Q Z / F D I O H V
, QFUHDVH WKH QXP E H U H P Q & 5 & S R V L W L R Q V L W Q W K W & K \ D U L V H
DQG RWKHU UHVHDUFK FKDLU
SRVLWLRQV LQ HPHU & R P S X W H U 6 F L H Q F H K D Q H Z H I D F X D M G R O P E H Z K L Q L S S D I S S O \ L Q J K R V D D Q S L G D W H
DUHDV ± FXUUHQWO D S R I Q W H G E H V Z H H Q & R P S X W H U 6 F L H Q F H D G G & 6 X U W K H U H F E G O L P Y H W R Q W
RQH MRLQWO\ DSSRLQW H G P E H U D Q X D V S H S D W W R O W F R P S O H P H O S R Q V H V Q G B W E R P P H E H O R Z
&5&
)DFXO V W K R X J K W K R H) D Q X O W F R Q P E H R O R W & 5 & W H G O R F L W H D F K G H S D U W P H Q W
DGYRFDWH IRU &5 & S R X D O V I E K O V H W U H T X H R W 6 F L H Q F H D U F X D L Q V I O H [L E O H W R
RSSRUWXQLW\ WR UKHF L D F L X D V \ & 5 & H I R O W M L R Q V R I D F S P O S L X W D W L R Q D O V F L H Q F H D F
LQFUHDVHV RSSRUWLXODLEVOHH &5& R F D L Q Q L G L Q G H D M K P H W L Q D B B P S X S D H U W 6 F X O D U O V
GHSDUWPHQW F D Q D V G Y R F D W H P H H D W F M K F R U F W L K W H E O D F W W D H W H I G L B H W I G L X Q L Y H U V L

0DLQWDLQ WKH QXP E H U H P Q & 5 & S R V L W L R Q V L W Q W K W & K \ D U L V H
DSSRLQWPHQWV EXZLWK R Q G O Q Q H H U & 6 J) H Q H R Z L W Z L W K Q H 0 & L W Q G % R R V W D W L V W L F V D Q G (S L G I
TSRUPP P E D A @ W I Z H Q & R P O @ E U E P O P U A E F E 0 @ P F H Q H R Z L W Z L W K Q H 0 & L W Q G % R R V W D W L V W L F V D Q G (S L G I
R I D G G L W L R Q D O R Y H U K H D G

*LYHQ WKH QHHGV RWWLQHWH S D V V R P H Q H D B K L Z H O H S H U W K H L Q W H U G L V F L S O L Q D
QRWHG E\ WKH UHYLPHZ G W V L W I K H I D S R X U W R I X R Q W R Q Q W Z B S S R D Q D M P O D E V O H W R
WHDFKLQJ DQG UHW R D W F K H P H S V L R Q P H Q W Z I K O ' H S D U W L R Q H W R E H D Z D U H R I F
DSSRLQWPHQWV H V S M I L D O X G H L Q W W D H G X X L W R P Q W D Q G O R S H D W W H Q W L R Q W R
'HSDUWPHQW ZLOOWKLG R Q H W I K G D E G L Q R U V W D I I P H P E H U V
)DFXO V R L Q W D S S R L Q W P H Q W S H 0 E 0 P D F ` V 0 A P E E F

VXSHUYLV RUV LQVWHDG RI 7\$V
7\$V FRPSODLQHG DERXW WKH
ZRUNORDG DQG 7\$ ZRUN QRW
XVXDOO\ UHODWHG WR WKHVLV ZRUN
7KH 'HSDUWPHQW VKRXOG KLUH
XQGHUJUDGXDWPHW WKH
7\$ UHTXLUHPHQWV RI WKH
FRXUVHV 7\$V DUH QRW SURYLGHG
WKDW PDQ\ UHVRXUFHV H J

G 0RVW GHSDUWPH QWSXWKH 6EJHGF&KOPHQBQOU BQMDIWH 8UKRIJUDP +
ZH UHFRJQLJH WKHUH LV D KXJH YROXRFH RVHJG DEG XDKLV B\$ISGFHF B\$GROW
PD KHOS UHOLHYH VRPH RI WKH ZRUN DQG VRPH WDVNV FRXOG PRYH W

,PSOHPHQWDWLRQ 3ODQ

7KH ,PSOHPHQWDWLRQ V3XPPD SURY LGHHV UHF W/KPHQ G B WLRUIH O O WZ RGS D,OG HFDU K F
WKH *UDGXDWH 3URR Q D P O & K D W U R Q Z E V K K W K H Q 6 R 3 6 W K Q G) D F X O W \ L V U H V S R Q V L E O
PRQLWRULQJ W K B D Q W E B Q M P Q H Q W D W L R Q 3 O D Q

7KH QXPEHU RI UHFRPPHQLQJ DWLRQV ISPSOHPHQW B W X R Q G R D W V B H W K H V F R S H R
,4\$3 DQG DUHD DOUHDG W L R H Q G D F D D Q G G H E / F U L E H G L Q W K H S U R J U D P D Q G I D
DERYH \$ V D U H V X O W G D W K L R Q V H Q R P H O S S K H P H R W D W L R Q P W B Q G B W L R Q U H F R
D Q G E F

5HFRPPHQGDWLRQ	3URSRVHG \$FWLRQ DQG)R	5HVSQRVLEL	7LPHOLQH
----------------	-------------------------	------------	----------

5HFRPPHQGDWLRQ

([DPLQH KRZ GHSDUWPHQWDO VSSDFHWIPVH Q X U & K I D L W O \
,QFUHDVH LPSURYH SK\VLFDXZRGNDLQG LGHQWLI\ VSHFLILF QHHDGXDWH &KDLU
HQYLURQPHQW \$V QHHGHG GUDIW D SODQ IRQIWLKHH RI WKH 'HDQ
FUHDWLRQ WUDQVIRUPDWLRQ R D F S O P H R I 6 F L H Q F H
'LVFXVV ZLWK)DFXOW\ OHDGHUVKLS

#

5HFRPPHQGDWLRQ

D

7HDFKLQJ DQG 6XSHUYLVLRLQ 7UDFN FRPPLWVHH PHPEHUV DQG DQXDO LQWUHYLHZV
XVLQJ WKH 3DWKILQGHU VRIWZDUH SURYLGHG E\ 6*36

D (QVXUH WKDW WKH UH DUH VXSHUYLVRU\

FRPPLWVHHV IRU 3K' VWXGHQWV QH WKH SB B W H Q R V L D R Q U H V H D U F K

E &UHDWH D FRPPRO JHQH U D W K R G R O R J \ F R X U V H I R U 0 6 F V W X G H Q W V

UHVHDFK PHWKRGV FRXUWHG U ` H L G Q P p @ 0

UHTXLUHG IRU DOO 06F VWXGHQWV DQG VWUDWHJLJH FRXUVH RIIHULQJV WR PHHW

DQG UHTXLUH WKHP IRU 3K' KH QHGV RI WKH SUURVHV RI WKH VWGHS €•WQWP0VW WKH SU

VWXGHQWV ZKR KDYH QRW VWXGHQW DQG WKH GHPDQGV RI WKH MREVW @P@€0p€ W0HI#7

VLPLODU RQH EIRUH :RUN WRZDUG WKH GHYHORSHPHQW DQG DGPLQLVWUDWLRQ

F ,QFUHDVH WKH QXPEHU RI JUDGLDWYV XDMRQ R F R X U V H F D O H Q G D U

FRXUVHV EHLQJ RIIHGHG

G &RQVLGHU RIIHULQJ FRXUVHV PHFKDQLVPV IRU EDODQFLQJ QRQ WKHVLV

DOLJQHG ZLWK WKH FXUUHQW VWXGHQW VXSHUUDERXO VEHVZPEHUV

PDUNHW

&RQVLGHU VHWWLQJ XS WKH 06F SURMHFW DV D

H 5HTXLUHPPHQWV IRU D SURMHFW LQ D

SURMHFW EDVHG 06F VKRXO@p€•€ p@À

FODULILHG LQ RUGHU WR PDQDDEÀ 0@€p@p @

VXSHUYLVLRLQV H[SHFWDWRQ 'A0X 00 WX0V7DI U@0@ °€0

X p€0 p p p p A p • W Q W P Q P €

X V E T N H Q I W K C H U Y L V L € 0 Q H ' D I 4 ' R 8 [G W A 0 € ° ` p p 0

5HFRPPHQGDWLRQ ""
' Å! p R @0 '\$W` Trri